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Shipbuilding in Germany

IT is becoming increasingly evident, as time goes on, that the war, disastrous as was its immediate effect upon German shipping, was in reality a blessing in disguise. While many of the vessels captured by or turned over to the Allies were of great value, and for the time being next to impossible to replace, by far the larger number were old ships, many of them near the limit of useful age; not infrequently they proved a liability rather than an asset to their new owners, and served to delay the construction of new and modern tonnage rather than any useful purpose.

Germany, on the other hand, with a clean slate, was forced to begin the construction of a new fleet, practically from the bottom up; and this at the time when the motorship was coming most rapidly to the front and seriously challenging steam in the long voyage trades. The result has been one of the most rapid "come backs" that the world has known, for today less than 9 years since the end of the war, the German merchant marine, while not yet boasting its total tonnage of pre-war years, is rapidly approaching that figure, and this immense fleet is comprised very largely of new and modern vessels—a large proportion of them motorships.

The building of these new vessels has not proved an unmixed blessing to the German shipyards. They, in common with every other industry, suffered in the period of readjustment following the war. Both financial and labor conditions were unstable, even chaotic, and as a result much work was taken at a loss, both for domestic and foreign owners, in certain cases with disastrous results so far as the financial outcome was concerned.

It seems now fairly evident that the period of reconstruction is about over and the industry has finally got its feet on the bottom and is making sure, if not rapid, progress towards real and material prosperity. At least, this is the impression that one gains from the shipbuilders themselves although it is regretfully admitted that prices are still too low to be productive of any material profits.

While the large shipyards are by no means filled with work, there is a large amount on hand and one yard, that of Blohm and Voss at Hamburg, is reported to have a greater total of tonnage under construction or contracted for than any other in the world, at the present time

Of the ships now building, perhaps the most notable is the *Cap Arcona,* recently launched at Hamburg and intended for the trade between Germany and South America. This ship, a full description of which will later appear in MARINE ENGINEERING AND SHIPPING AGE, is a twin screw passenger and cargo steamer something over 600 feet in length, propelled by geared turbines. An interesting feature of this vessel is the equipment of four Diesel engines for driving practically all of the auxiliary machinery. It is of further interest to note that the heat in the exhausts from these engines will be utilized in a special small boiler to provide a portion of the steam for the main turbines, or for other purposes.

The most important work in prospect for the German yards is two very large and very fast steamers for the transatlantic trade. It is stated that one of these vessels will be constructed at Hamburg and the other at Bremen, that the designed speed is 26 knots at sea but that about 26.8 is expected to be realized in service.

The advisability of building these very costly ships is seriously questioned in certain quarters in Germany, it being held that they will be quite unable to carry themselves, financially, and that in view of Germany's present political condition in relation to other nations she should confine herself, for the present at least, to the construction of ships which give definite promise of profitable, if not of phenomenal, performance. It may be noted that the largest German shipping company, the Hamburg-American, is following this latter course and in its new tonnage is adhering to ships of moderate speed and considerable cargo capacity combined with comfortable but not extravagant passenger accommodation.

The thoroughness and seriousness with which the Germans have taken up post-war shipbuilding is evidenced by

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the establishment of the Hamburg experimental model tank. This remarkable institution with what is probably the most complete and up to date equipment of any of its kind is maintained by private firms—shipowners and shipbuilders—and under the direction of Dr. Kempff is not only performing commercial work in connection with the design of new vessels but is carrying forward scientific researches of the utmost importance and value to the whole shipping community.

Ship Safety Work

WHAT has been done on the bulk freighters on the Great Lakes to make the work of the officers and men who operate the ships safer is an object lesson for the owners and operators of sea-going vessels. While certain of the hazards involved in a seafaring life are dangerous in the extreme and may never, even under the best of conditions, be wholly eliminated, there is no reason why many of the accidents due to carelessness on the part of the men themselves should not be avoided by the application of common sense practices and suitable precautions which can be evolved and utilized by the crews of the vessels. How successfully this object can be attained is shown by the results of the work of the ship safety committees on Great Lakes vessels during the past nine years.

Of the features instituted by the Lake Carriers' Association none has achieved more beneficial results than the welfare plan which has been in existence for eighteen years. The welfare work of the association had been in operation nine years before the idea of appointing ship safety committees on the vessels of its members was conceived. The records of the welfare work of the association, therefore, cover two periods of equal length, the nine years before the ship safety committees were established and the nine years during which they have been in operation on more than 200 vessels operated by members of the association. During the nine years without ship safety committees, according to figures published in the latest issue of *The Bulletin* of the Lake Carriers' Association, the death and total disablement benefits resulting from injuries sustained in the service totaled 181 while during the nine years since the ship safety committees have been at work the number of fatalities totaled only 94. With the exception of masters, the number of fatal injuries has been cut in half in all grades of licensed men and among the able seamen. Among the ordinary seamen, who comprise the inexperienced and perhaps the more careless members of the crews, the number has been reduced from 70 to 42. These figures speak for themselves and mark an achievement that deserves the closest study by vessel owners and seafaring men the world over.

The ship's safety committee is composed of six members of the vessel's crew. Each member of the committee receives an annual bonus if no injury has been sustained by any in the ship's company that caused him to leave the ship during the year. In connection with this the Lake Carriers' *Bulletin* points out that in the fleet of the Pittsburgh Steamship Company this bonus has been paid for no less than five consecutive years on no less than seven steamers, for four consecutive years on six other steamers, for three years on eight other steamers, for two years on 13 other steamers and for the year 1926 on a total of 34 steamers. Similar excellent results have been obtained in other fleets, 30 committees in the Interlake fleet having been awarded the bonus in 1926 and on 4 vessels of this fleet the bonus has been paid for 4 consecutive years. As these results cover practically all lost-time accidents, the value of this method of accident prevention is apparent.

Not the least important result of the ship safety work on the Great Lakes is the way in which the men on the ships have given their time and thought to the development of devices to safeguard their shipmates from injury and death. Some of the most widely adopted devices originated in this way were illustrated and described by Mr. George A. Marr, secretary of the Lake Carriers' Association, in a paper read at the last annual convention of the National Safety Council. An abstract of this paper is published on page 349 of this issue and while many of the devices are applicable only to the conditions arising in the operation of vessels on the Great Lakes nevertheless the scope of the inventions points the way at least to the possibilities of obtaining similar results in ocean shipping. Although safety committees are not found on all the vessels operated by members of the Lake Carriers' Association, the work of the safety committees is well known everywhere on the lakes and the results of their work extend far beyond the ship, or the fleet, or the association primarily responsible for this movement.

Hitherto safety work on sea-going vessels has suffered from the lack of effective organization work. Recently, however, the Marine Section of the National Safety Council has been conducting an active campaign for membership and through the efforts of its executive committee it has been disseminating to the members by means of a *News Letter* useful information regarding its meetings and safety activities. The response to this movement has been gratifying and through membership in this branch of the National Safety Council shipowners should find an opportunity for more effective development of safety methods, the analysis of results and a wider appreciation of the benefits to be derived from the cultivation of the "safety first" spirit on board ship.

The Longshoremen's Compensation Act

BECAUSE the Longshoremen and Harbor Workers' Compensation Act, which becomes effective on July 1, has a wider application than is generally understood, its terms and the methods by which it will be administered are fully outlined in an article on page 345 of this issue. The act applies to longshoremen engaged in loading or unloading vessels and to mechanics, carpenters and other ship repair men working on a vessel afloat, provided the vessel is of 18 tons or over. This class of workers has been without compensation protection since 1917, because of a Supreme Court decision at that time which ex-

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cluded them from state compensation benefits. The act applies not only to seaports but to all navigable water (including dry docks) in the United States, and that means lakes, rivers and canals which form a continued highway for interstate or international commerce. Previous to the enactment of this law, the longshoreman or other harbor worker, if injured on the dock or on shore, received the benefits of the state compensation law but if injured in the performance of his duties on board a vessel he was obliged to seek compensation under the admiralty law or under the common law. Damages awarded in this way followed no scale whatsoever and the results were so uncertain that neither the employee nor the employer could gage the outcome. The new law provides for compensation according to a fixed scale, which will eliminate the uncertainty involved in previous damage cases. The basis of compensation for disability is two-thirds of wages, the maximum weekly benefit being $25, while the total compensation payable for injury or death may not exceed $7,500.

That difficulties will arise in the administration of this act, for a time at least, is apparent from the fact that after passing the law Congress adjourned without making any appropriation for its administration. The act is to be administered primarily by the United States Employees' Compensation Commission and it was originally expected that 12 compensation districts would be created although this number has been reduced to five. The matter of jurisdiction is likely to be troublesome for it is not clearly defined in the act. As most state compensation laws are less liberal than the new federal act the question of jurisdiction may naturally play an important part in the settlement of any case. Just how satisfactory the administration of the act will prove to be, time alone will tell. To many, at least, it will be a relief to have such compensation fixed by law and not subject to the decision of a jury.

Oil Engine Research Problems

THAT the design of oil engines offers one of the most important fields for scientific research is shown by the papers and discussion presented at a three-day oil engine conference held in April at Pennsylvania State College where engine builders and users, oil producers and oil refiners were brought together for the discussion of mutual problems. Although rapid progress has been made in recent years in the design and manufacture of oil engines for various purposes, many of the developments have been as much the result of trial and error methods as of a scientific knowledge of what actually takes place in the combustion of the fuel in the engine. As one speaker put it, we have no knowledge of fuel characteristics nor of combustion comparable in technical importance and scientific precision with the information at the disposal of the steam turbine engineer. Where the steam engine designer can forecast on paper, the oil engine designer must cut and try with cast iron and steel.

In showing how far the oil engine of today falls short of perfection, Professor P. H. Schweitzer called attention to the thermodynamic analysis of internal combustion engine cycles recently made by Professors Goodenough and Baker at the University of Illinois, in which the authors made a very careful analysis of the theoretical possibilities of such engines. After painstaking calculations they came to the conclusion that for a compression ratio of 12, which is common in solid injection engines, the mean effective pressure could be as high as 173 pounds per square inch in an ideal Diesel type engine working with the theoretical amount of air. Even when using 100 percent excess air, a mean effective pressure of 136 pounds per square inch is theoretically possible. With the commercial engines available today, however, an indicated mean effective pressure of 80 pounds per square inch is considered very good and the majority of the engines do not reach 50 pounds. The thermal efficiency of the ideal solid injection engine working with 100 percent excess air is not less than 49 percent. Such an engine would deliver a horsepower hour from 0.22 pound of oil if it had 85 percent mechanical efficiency.

Professor Schweitzer pointed out that no one can hope that this goal will be reached by a single discovery. Various factors are involved and the progress will probably be a gradual one. One of the factors regarding which little is known but which has a most vital effect on the performance of an oil engine is the action of the fuel spray before ignition. This question is now being made the subject of an exhaustive investigation at Pennsylvania State College and as a result it is hoped to furnish designers with facts and data that will enable them to construct more efficient and higher speed engines.

British Shipbuilding

EVEN a superficial survey of the principal centers of shipbuilding in Great Britain furnishes rather conclusive evidence that in this department, at least, British industry is on the up grade after its long and discouraging period of depression.

The shipyards are by no means all filled to capacity and keen continental competition has forced a scale of prices which, in many instances, can afford little or no profit to the shipbuilders, but, nevertheless, there is a very substantial amount of work in hand and there seems to be a general feeling of hopefulness throughout the industry and a disposition to look forward to the future with increasing confidence.

It is true that, in some quarters, there is an inclination to regard the recent large influx of shipbuilding orders as a more or less temporary matter but after talking with both shipowners and shipbuilders one cannot but feel that there is a very general and growing undercurrent of confidence and that where pessimism is expressed it is a "leave over" from the trying experiences of the past few years which the present very real and material turn towards prosperity has not yet had time to entirely efface.

To come down to facts; there are at present under construction in Great Britain and Ireland, approximately 300 mercantile vessels having an average gross tonnage of between 4,100 and 4,200. Thus it will be seen that the new vessels are, in general, of considerably greater size than was

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common a few years back and it will be found, moreover, that the average power of their propelling machinery is increasing at a higher rate than their tonnage; a very clear indication of the present world-wide tendency to higher speed and consequent greater regularity of service in cargo vessels.

While the total tonnage under construction has not yet reached pre-war figures, the increases in size and power are serving to make the present day ships much more expensive than their pre-war prototypes, even when no account is taken of the great increase in cost of both material and labor which has been one of the results of the war.

There are still other factors which cause the present investments of British shipowners in new vessels to run to very high figures. One is the large number of new tankers which has been ordered, considerably over one quarter of the total tonnage in course of construction being in this class of vessel. There are also a number of very large refrigerator ships and combined passenger and cargo ships of high class and relatively high power building for certain of the leading lines, both for transatlantic and for eastern trade. Finally it may be noted that over one-third of the new British vessels will be propelled by internal combustion engines, a further and rather convincing proof of the confidence of the British shipowner in the immediate future of his business.

Turning more particularly to the engineering aspects of the present shipbuilding activity, it may be said that so far as hull construction is concerned there are no particularly radical or unusual departures from standard practice. In this connection the new Isherwood system of bracketless hull construction for tankers should be mentioned. The first vessel of this type is now in service and is reported to be entirely satisfactory. Several more have been ordered and judging from the comments of very high shipbuilding authorities, it seems quite probable that the "bracketless" system will follow in the path of its predecessor and eventually become the standard for tank vessels.

It is in the engine room that by far the greater part of recent ship development has taken place. That the Diesel has a firmly established place in the long voyage trades is an undoubted fact. Although Great Britain is still building many more steamers than motorships, the latter comprise over one-third of the total tonnage at present being built or for which contracts have been placed. While the four cycle engine is, in general, conceded a very high place from the point of view of reliability—this mainly because of the longer practical experience with this type—two cycle engines, particularly of the Sulzer and Doxford designs, appear to be growing in favor. The latter company has an enormous amount of work in hand; enough, so it is reported, to keep its machine shops running on a 24-hour schedule for a year to come. Diesel engines are to be fitted in many of the higher powered ships now building, but are not likely to be adopted in certain very large and fast liners for the Atlantic service, the construction of which is understood to be definitely decided upon but for which contracts have not as yet been placed. These latter vessels will probably be fitted with high pressure turbine machinery and watertube boilers.

Turning to steam machinery, the reciprocating engine still holds a high place in the estimation of British engineers and shipowners, as is demonstrated by the fact that out of a total of nearly 900,000 horsepower of propelling machinery at present being built in Great Britain and Ireland something over 350,000 horsepower is of the steam reciprocating type The total horsepower of steam turbine installations is in the neighborhood of 200,000, but it should be noted that the average of the latter is around 10,000 horsepower while the reciprocating plants will average about 1,600, the turbine plants being mainly confined to relatively large or high speed vessels.

The advent of the high pressure turbine steamer *King George V* has, without doubt, greatly strengthened the position of marine steam machinery. This vessel, which, incidentally, is a remarkably fine example of the highest type of shipbuilding and engineering skill, has proved eminently successful and is reported to have fully met the expectations of her designers and builders. Certain defects of engine room ventilation which at first gave trouble have been entirely remedied and the entire steam plant is reported by the chief engineer of the vessel to function in an entirely satisfactory manner. The condensers, in regard to which some apprehension was naturally felt, have as yet failed to give trouble, although the ship has perhaps not yet been sufficiently long in service to offer entirely conclusive evidence on this score. Several different types of tubes are installed but so far none has given evidence of undue deterioration or wear. In this connection it may be noted that condenser tubes of copper-nickel alloy are being experimented with extensively in Great Britain and are reported to give very satisfactory results.

Aside from its thermodynamic or fuel saving possibilities, the high pressure steam plant is receiving favorable consideration in Great Britain because of its ability to use coal fuel. The British Isles have no home supply of oil but they possess practically inexhaustible stores of coal and there is a very strong feeling evinced that too much dependence should not be placed upon outside supplies of fuel. The success of the new type of steam plant will go far towards allaying any uneasiness on this score. In this connection, the greatest interest is shown in the development of pulverized coal burning and its application to marine uses. Some engineers appear to be hesitating between automatic stokers and pulverized coal, but there is little doubt but that once the burning of the latter under marine boilers has been demonstrated to be a practical success, its extended adoption in conjunction with high pressure steam plants will follow.

To the American shipbuilder, the British yards and their product are ever of consuming interest. They represent the accumulated knowledge and experience of many years—an experience not approached by any other country. There is much that the foreigner can learn from them, perhaps the most important lesson being the evident elimination of all non-essentials and the use of plenty of good material and careful workmanship where the lack of them is sure eventually to rebound in the form of excessive upkeep and replacement or repair charges or even in failure and disaster.

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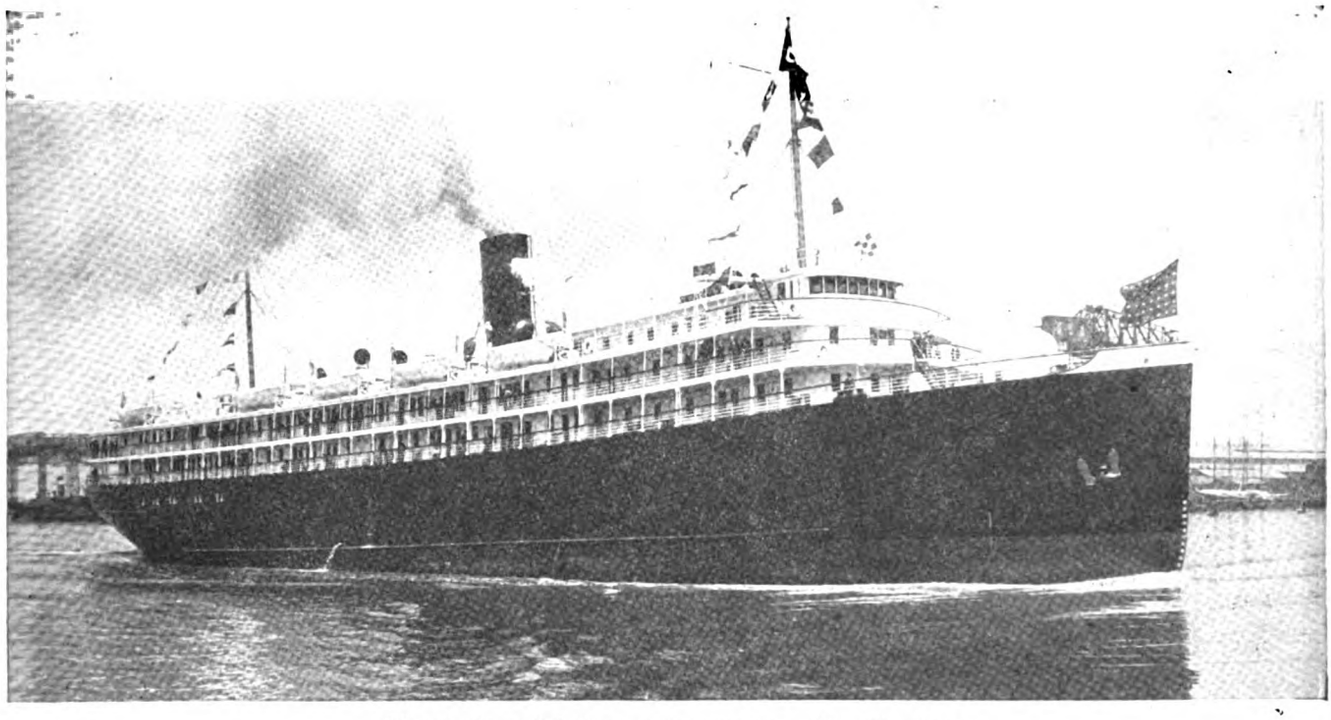

Merchants and Miners passenger steamship Chatham

The New Merchants and Miners Coastwise Liners

Steamships Chatham, Dorchester and Fairfax built by the Newport News Shipbuilding and Dry Dock Company for the Merchants and Miners Transportation Company

AS a fitting climax to seventy-five years of successful steamship operation three fine new combination passenger and freight ships, the *Chatham, Dorchester* and *Fairfax,* have been added to the fleet of the Merchants & Miners Transportation Company, Baltimore, Md. This company was formed on April 23, 1852, and a study of the prints of the ships of bygone days hanging on the walls of the president's office in comparison with the new ships just built shows the progress which has been made in shipbuilding in this country during the many years this company has been serving the public.

A progressive hand is at the helm of the company in Mr. A. D. Stebbins, president and general manager, as it is less than four years ago since he built the *Alleghany* and *Berkshire,* two very fine combination passenger and freight ships, and gave such a start to the new coastwise building program.

Having added five new ships to the fleet the company is now in an excellent position to carry on the service they have been giving for the last 75 years.

The *Chatham, Dorchester* and *Fairfax* were built during 1926 at the plant of the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., from specifications and plans submitted by and developed under the supervision of Mr. Stebbins.

Main Hull

The principal dimensions are as follows:

Length overall	368 feet
Length between perpendiculars	350 feet
Breadth, molded	52 feet
Depth, molded to hurricane deck	36 feet
Draft, loaded	19 feet
Gross tonnage	5,649
Net tonnage	3,456
Deadweight tonnage	3,300
Sheer, forward	5 feet 6 inches
Sheer, aft	2 feet 9 inches
Block coefficient	0.702
Midship section coefficient	0.977
Indicated horsepower	2,850
Speed	12 knots
First class passengers	302
Third class passengers	12
Officers and crew	87

The vessels are of steel hull construction, built on the Isherwood patent system of longitudinal framing, under special survey and to the highest class ✠ A.1 (E) of the American Bureau of Shipping. A double bottom, 43 inches high extends from the fore peak bulkhead to the after peak bulkhead, with watertight division along the centerline and subdivided into tanks Nos. 1, 2, 3, 4, 5 and 6. Tanks Nos. 2 and 3 carry oil, Nos. 4 and 5 carry fresh water and Nos. 1 and 6 carry ballast water.

Six watertight bulkheads are fitted as follows: Fore peak, middle of forward hold, forward end of boiler room, after end of engine room, middle of after hold and aft peak bulkhead, with a strong dust proof bulkhead between the engine and boiler rooms. The fore and after peak bulkheads extend to the main deck, the remainder to the lower deck, fresh water or ballast is carried in the peak tanks.

Four steel decks are fitted and named as follows: Orlop, lower, main and hurricane. The hurricane and main

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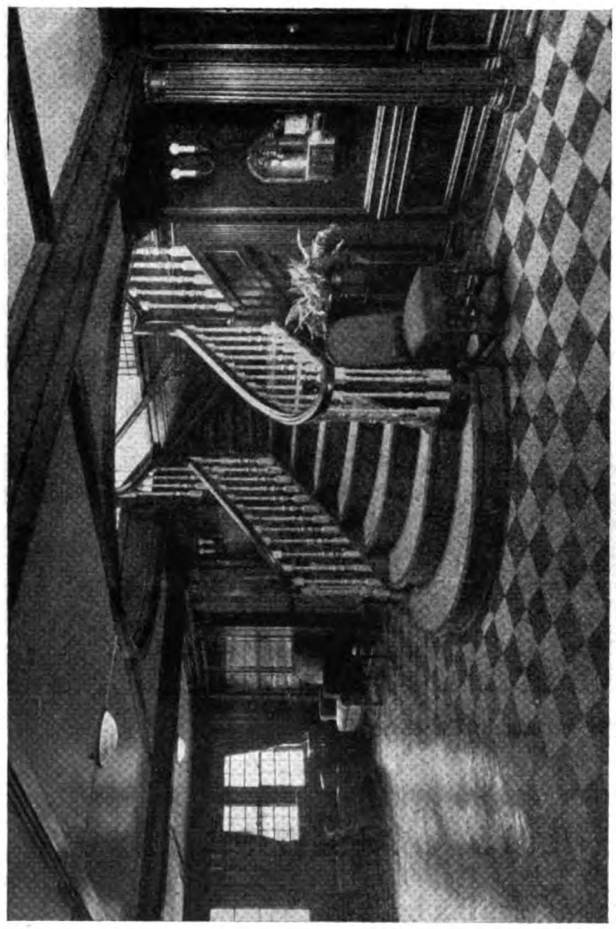
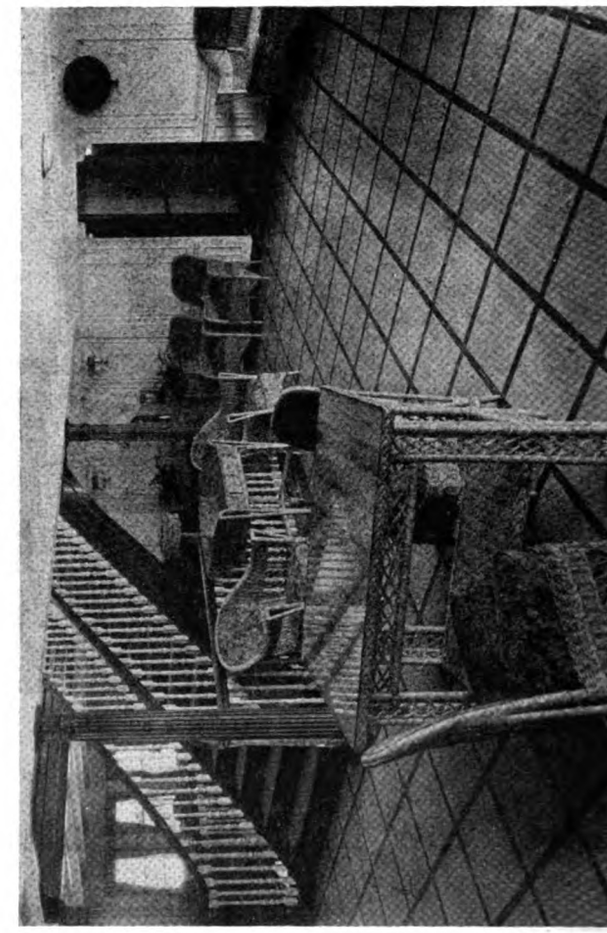
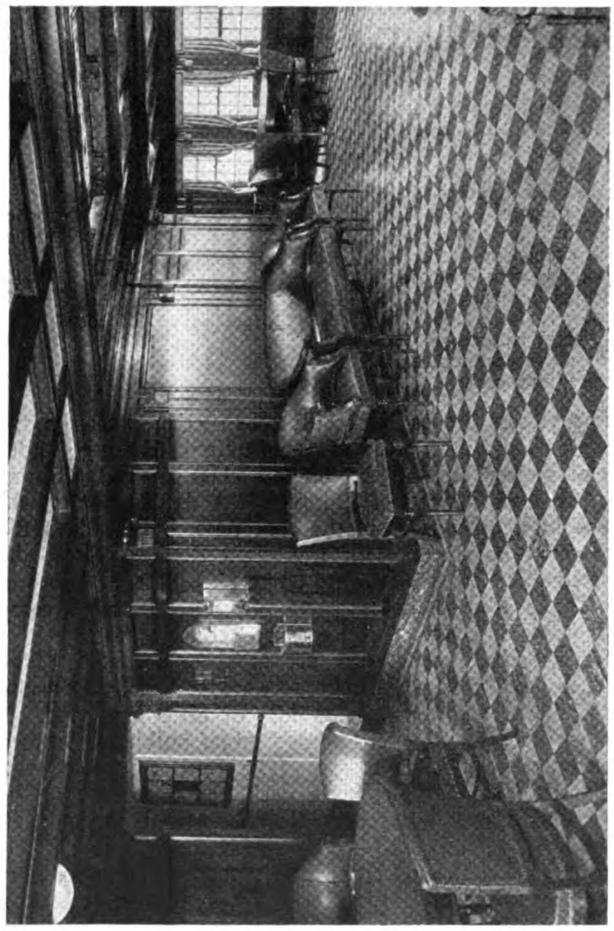


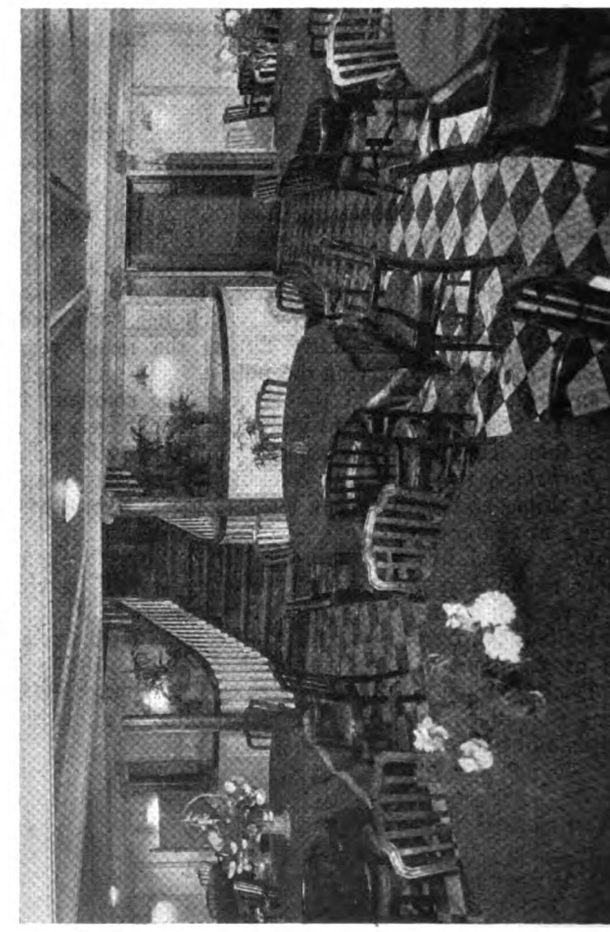
Lounge, looking aft



Social hall, looking forward



Smoking room, looking to port



Dining room, looking forward

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decks have a 9-inch camber, the remainder being straight. Freight is carried on the main deck forward and on the orlop and lower decks and holds, the plating on these decks being joggled to give a flush trucking surface.

Five hatches of large size are fitted in the lower and orlop decks, and three in the main deck forward. Each hatch is fitted with rollers to prevent rope chafing and steel brows for easy trucking.

Two twin cylinder single drum 8¼-inch by 8-inch Lidgerwood hoisters with steel plate and angle jib cranes each capable of sustaining a working load of 2½ tons on the fall are fitted at each hatch on the main deck forward and at each hatch on the lower deck aft.

Seven cargo ports are fitted on each side of the vessel, five between the main and lower decks and two between the main and hurricane deck forward. The width of the cargo ports being 10 feet and the height varying from 6 feet 9 inches to 8 feet 2 inches will permit the entrance of the highest type of automobile or truck into the ship. The doors of the ports slide on tracks above the openings supported with heavy chains.

Fitted at each cargo port is a permanent steel brow inclined in both the fore and aft and athwartship directions which permits of easy trucking in and out of the vessels.

Ventilation to the freight compartments is taken care of by natural means through large cowls and ducts carried in such a manner as to offer least obstruction in handling and trucking freight.

A center row of widely spaced tubular pillars takes care of the strength requirements and gives the necessary room for swinging large timbers, etc.

The midship thickness of shell is carried forward to the stem between the light and load water lines as a protection against damage by ice.

A heavy dished plate guard filled with pitch is fitted port and starboard fore and aft as a protection for cargo port doors and bumping an rubbing wharf piling.

Steel houses are fitted on the hurricane and promenade decks, with steel beams, girding, pillars, stringers and tie plates on both the promenade and boat decks. Strong web plates and steel bulkheads make these houses of very strong construction.

Outside the house on the hurricane deck on top of steel a calked and payed vertical grained Oregon pine decking is laid. The promenade and boat decks are sheathed with tongued-and-grooved Oregon pine and covered with felt and canvas outside of the houses.

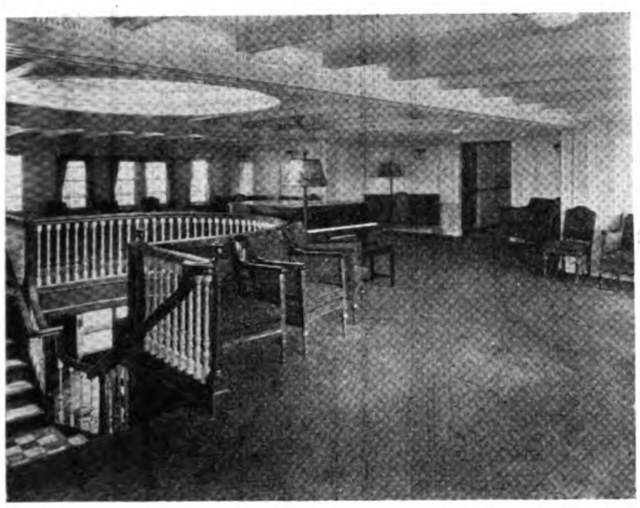
The dancing pavilion, officers' quarters and pilot house on the boat deck are of wood construction paneled in white pine.

All outside doors are heavy white pine paneled, with Mason non-slip safety treads on the deck outside each door in place of the regular slats or gratings which always had a tendency to damage the small heels of ladies' shoes or perhaps cause serious injury.

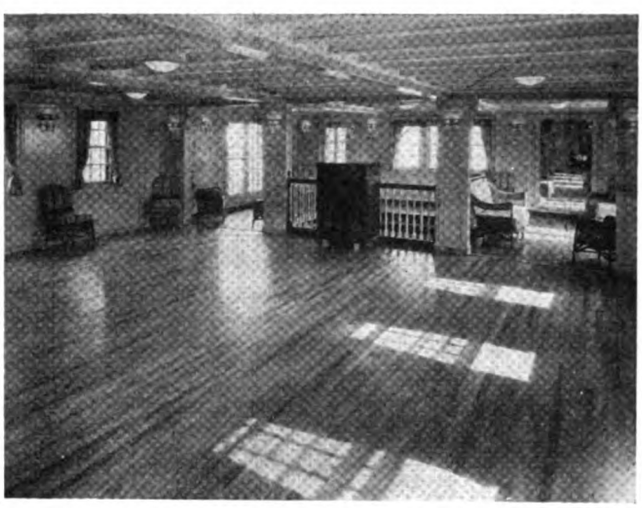
The windlass with an attached capstan on the hurricane deck above is of the Hyde spur gear type driven by 9-inch by 10-inch horizontal engines.

Accommodations are provided for 302 first class passengers, 12 steerage and 87 officers and crew.

Three thousand three hundred tons of cargo, fuel and stores, etc. can be carried on a load draft of 19 feet, making a total displacement of 6,950 tons.



Music room, looking to port



Dancing pavilion, looking forward

MAIN ENGINES AND BOILERS

The main propelling machinery consists of a single four cylinder triple expansion engine with cylinders 25 inches, 42½ inches, 54 inches and 54 inches in diameter by 48 inches stroke developing 2,850 indicated horsepower at 84 revolutions per minute. Steam is supplied by four three-furnace single end Scotch boilers built for a working pressure of 200 pounds per square inch and having a total heating surface of 9,740 square feet. Oil is used as fuel and the latest Todd mechanical atomizing fuel oil burning system with forced draft is installed.

Propulsion is by a single 4 bladed, built-up bronze propeller 17 feet in diameter and 17 feet 3 inches pitch with a projected area of 81 square feet and a developed area of 97 square feet.

The main condenser has a cooling surface of 4,030 square feet and the auxiliary condenser a cooling surface of 800 square feet. A Reilly feed water heater and Griscom Russell fuel oil heaters are fitted.

Worthington pumps in duplicate have been used throughout the various systems with bronze water ends in all except the fuel oil pumps. The pumps include the following:

One vertical twin air, 12 by 26 by 18 inches.
Two vertical simplex feed, 14 by 9 by 24 inches.
One vertical simplex auxiliary feed, 9 by 6 by 12 inches.
Two vertical duplex fire and ballast, 12 by 8½ by 12 inches.
One combined air and circulating, 10 by 12 by 12 by 12 inches.
Two horizontal duplex sanitary, 7½ by 6 by 10 inches.
Two horizontal duplex deck service, 7½ by 5 by 6 inches.

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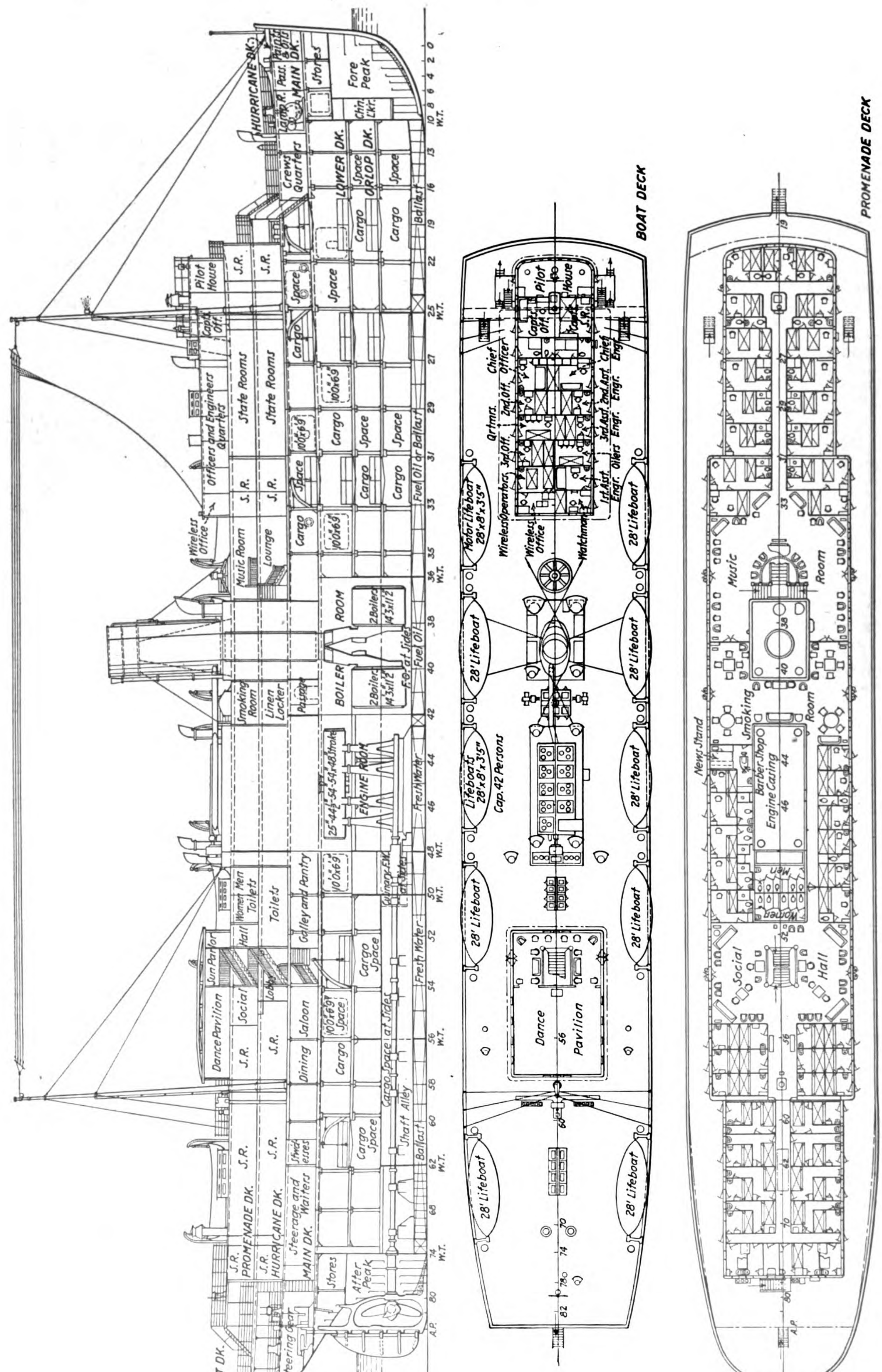

Inboard profile and plans of the boat and promenade decks of the new Merchants and Miners passenger and freight steamships

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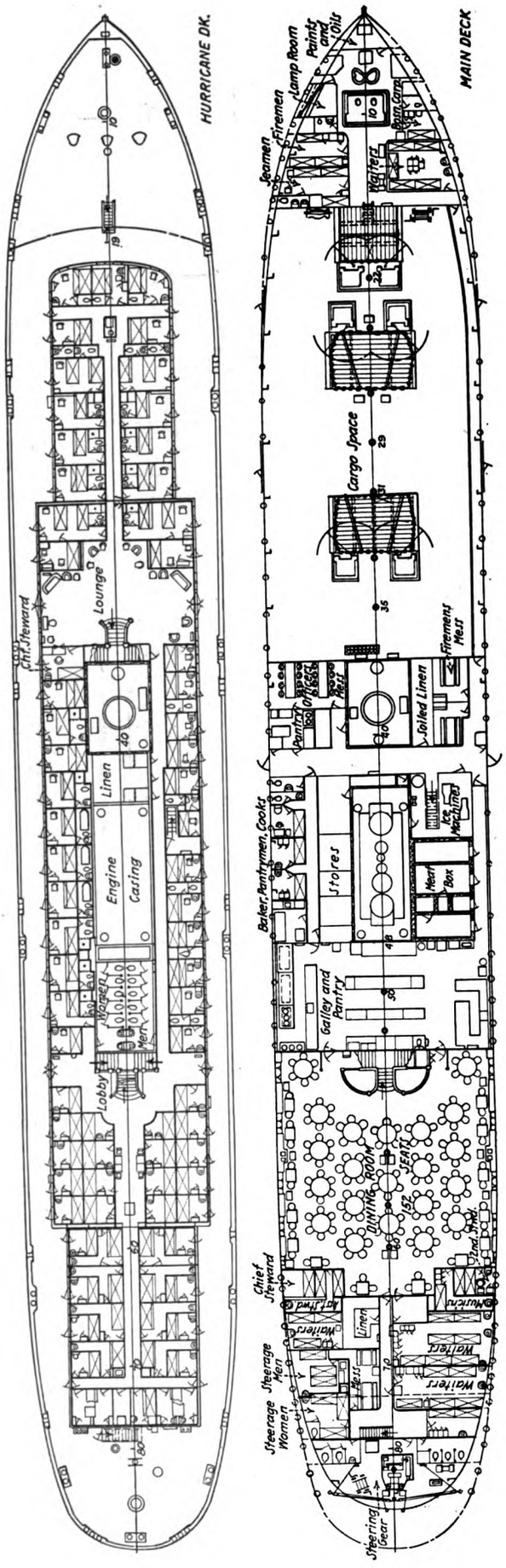

Plans of hurricane and main decks

One vertical duplex oil transfer and bilge, 6 by 6 by 6 inches.
Two vertical duplex fuel service, 5½ by 4 by 8 inches.
Two vertical duplex fresh water, 5¼ by 5 by 5 inches.
One horizontal duplex hot water, 4½ by 3¾ by 4 inches.
Two horizontal duplex ice water, 3 by 2¾ by 3 inches.
One circulating, 14 by 14 inches.
One attached bilge, 7 by 9 inches.

The electrical requirements are taken care of with two 40-kilowatt Terry turbine generators which may be connected in parallel should such an occasion arise for any overload.

The emergency generator is a Mathews 5-kilowatt automatic motor driven machine, using gasoline as fuel and is capable of suppling sufficient current for radio work, navigating lights and emergency lights, and is located high up in the engine casing.

As an aid to economy in fuel consumption a Noland oil and air regulator, together with a Bristol recording pyrometer for stack temperatures and equipment for taking analysis of stack gases have been installed.

Seamless drawn steel piping has been used for the main steam lines with copper branch lines to the various auxiliaries. The entire layout of the engine room of these vessels could very well be taken as an example of what can be done to give the greatest possible freedom of movement and accessibility for the maintenance and repair of the main engine and auxiliaries.

SAFETY IN NAVIGATION

Realizing how important correct navigation can be to the safety of a vessel, no expense was spared in equipping these new ships with all the most modern appliances. In addition to the two Kelvin White magnetic compasses each vessel is equipped with a Sperry gyroscope compass and recorders, which are in continual use and giving the utmost satisfaction. No more complaints are received due to automobiles loaded in these ships affecting the gyro-compass. Great as the guiding pointer of a compass is in determining the vessel's position a heavy fog can often cause considerable worry so a Radio Corporation compass-bearing and direction finder has been installed, together with the Submarine Signal receiving apparatus which have given the captain the latest aid science can contribute to safe navigation. There is also installed in the pilot house of these vessels a Sperry course recorder, speed indicator and helm angle indicator and on top of the pilot house a Sperry high intensity searchlight making the navigating equipment most complete and modern.

The vessels are steered by telemotor control from the pilot house and by steam and hand at the aft end operating a Hyde right and left hand screw steering gear.

PROTECTION AGAINST FIRE

As a protection against fire these vessels are considerably ahead of any other coastwise ships, due to the design and equipment. The entire crew quarters under the hurricane deck are constructed with steel bulkheads and steel partitions with metal covered or steel doors. The dining room is separated from the large combination galley and pantry by a steel bulkhead fitted with steel sliding doors.

Steel deckhouses are fitted on the hurricane and promenade decks for the accommodation of passengers, these houses are subdivided with steel bulkheads and metal covered sliding doors.

Two very important features which are almost always overlooked have been carried out on these vessels. These are (1) an arrangement to prevent lead soil pipes from melting and (2) means to prevent the escape of steam or the fanning of a blaze through the ventilators, when fire is discovered in the freight compartments.

A 4-foot length of cast iron pipe with cast iron deck

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flange is fitted to all promenade and boat deck lead soil pipes where they pass through the hurricane deck into a freight compartment thus preventing the melting of the lead pipe and preventing the fire from reaching the passenger quarters. It was only after practicable experiments were made over a blast fire that this method was adopted.

The ventilators have steel shutters at each separate freight compartment which can be opened or closed with a chain pull, preventing the escape of steam or the inflow of air.

All freight compartments are protected with the Rich smoke detecting and steam extinguishing system with a detecting cabinet in pilot house and a steam manifold in the engine room.

The boiler room is protected with the Lux carbon dioxide system which will, in the event of an oil fire under the fireroom floor plates, completely smother the fire with gas, at the same time sounding an alarm to the engine room and fireroom force that gas is being emitted.

Every stateroom is provided with a Cory automatic fire alarm unit, which, in the event of the temperature rising above a certain point, will automatically register in the pilot house indicating the block in which the stateroom is located.

The regular fire alarm system in which an alarm is given by breaking a glass and pressing a push button is located throughout the public spaces and crew's quarters.

From the above it can be seen that every possible precaution has been taken against fire.

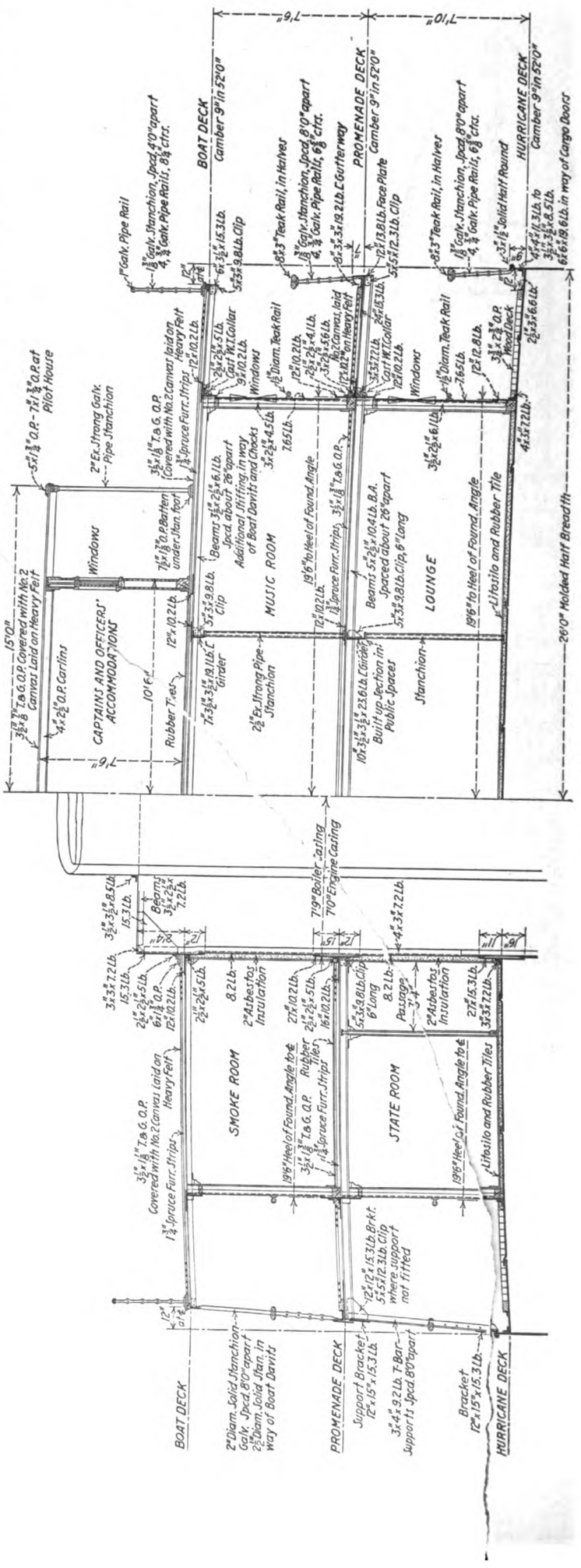
PASSENGER COMFORT

For the comfort of the passengers, the following equipment is provided in each stateroom: An intercommunicating telephone, electric fan, thermos bottle, metal medicine cabinet, berth reading lights, hot and cold running fresh water and a clothes locker. As can be seen from the plans many of the staterooms have private toilets and many others have private bathrooms with shower or bath in which salt water can be had as well as hot and cold fresh water.

The windows in all staterooms raise and lower, as well as jump a metal ledge when full up, simply by cranking a handle as with an automobile window. Above each window is a ventilating louver and wind scoop that opens or closes by turning a small crank.

In the various staterooms will be found a bed to suit every one's taste, double beds with Pullman bed above, twin beds with Pullman bed above or single beds one above the other. Every bed is equipped with a coiled spring hair mattress. Many of the rooms are communicating so that parties or families can be accommodated together. A large number of the rooms have inside as well as outside doors so that any part of the vessel may be reached without going outside. The floors of all staterooms, and in fact the floors throughout the entire passenger quarters except the music room are laid with rubber tile in various color schemes matching the interior decorations.

An inspection of the various public spaces discloses at once the spaciousness of each compartment. Above the music room is a circular leaded glass skylight of artistic tints. The floor is carpeted and the furniture is of light



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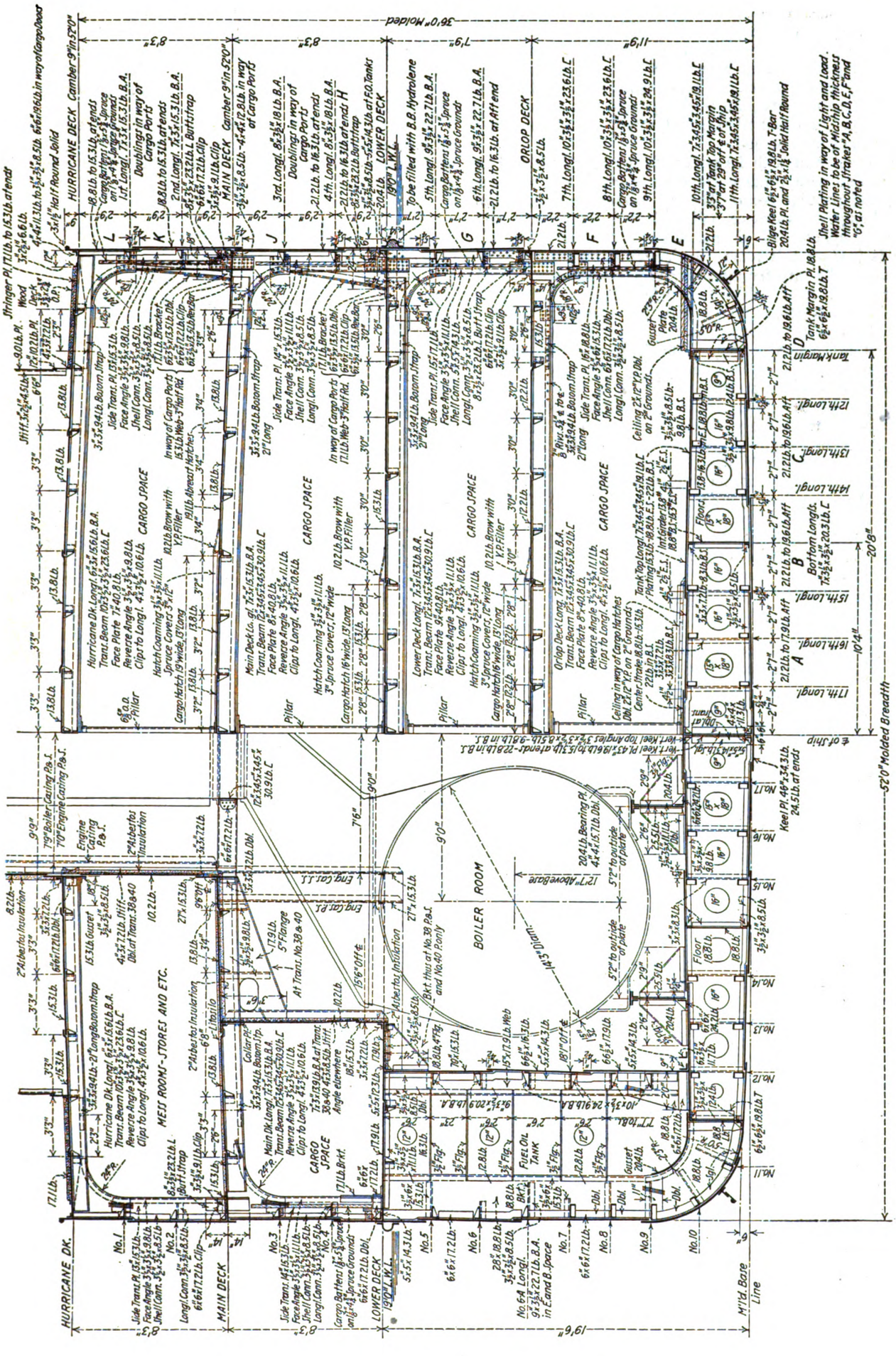

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colored mahogany with uncut mohair upholstery and window draperies to match. The smoking room also has a leaded glass skylight but in this room the walls and ceiling are paneled in mahogany and the chairs and tables are of mahogany, the chairs being upholstered in Spanish leather. Leading from the smoking room is a most up-to-date barber shop and news stand where the latest "bob" or magazines may be had.

The social hall with its wicker furniture upholstered in tapestry and with window draperies to match is a very inviting and popular room. Directly below the music room is the lounge or entrance hall with mahogany walls and furniture upholstered in mohair. The chief steward's office is just off this room. Ice water fountains are scattered about the ship for the passengers' convenience.

The dining room, which is capable of seating 152 persons, is artistically arranged with mahogany tables seating 2, 3, 5 or 6 persons with mahogany arm chairs upholstered in colored leather. The large windows add to the attractiveness of this room as they give a clear view on both sides of the vessel.

Forward of the dining room is a large galley which differs from the galleys on most coastwise ships inasmuch as in this case the galley and pantry have been combined into one large room. In it will be found the most modern electrical and steam cooking appliances together with monel metal serving tables, etc., giving the greatest efficiency in cooking and serving meals to the passengers.

Two 4-ton double condenser capacity ice machines of the Brunswick-Kroeschell make, keep the large refrigerators at their correct temperatures for the safe keeping of the various perishable foodstuffs.

Passenger Recreation

In these vessels recreation for the passengers has received the same care and thought as was given to their comfort.

A magnificent dancing pavilion has been constructed on the boat deck, beautifully decorated in a sea green with draperies, wicker furniture and upholstery to match. The floor is of polished maple. Music is supplied by either the ship's orchestra or an electric orthophonic victrola.

A public address and radio reception system has been installed for the passengers' amusement whereby music from the ship's own orchestra or the orthophonic victrola may be broadcast from the music room or dance pavilion to the dining room and social hall or to any one of these places separately. Over the same system radio programs may be received from any shore station and broadcast throughout the ship.

Shuffleboard and other deck games may be played outside on the spacious decks where an abundance of space is given over to passengers on the hurricane, promenade and boat decks.

In every respect these vessels are a distinct asset to the coastwise trade and reflect great credit upon the owners and builders for the design and construction of such magnificent ships.

Northland Goes into Active Service

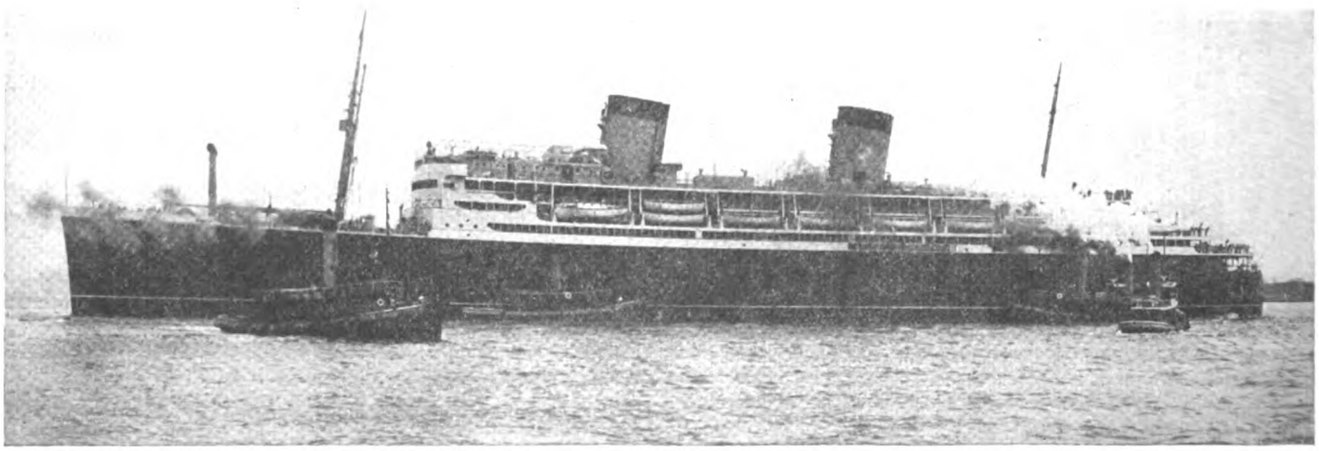
FOLLOWING a ten-day shake-down trial, the new Diesel-electric coast guard cutter *Northland* is now on her way to the Bering Sea, where she will be permanently stationed to continue the work of the historic *Bear* in iceberg patrol work and other humanitarian service in the Arctic. The final test period was started May 14.

The *Northland* is the first coast guard cutter to be equipped with Diesel-electric drive. She was constructed by the Newport News Shipbuilding & Drydock Company during the years 1926 and 1927 and was given her first sea trials at Newport News on April 26. She is designed for a speed of 12 knots, being driven by a single propeller running at a speed of 120 revolutions per minute. The total shaft horsepower of the propulsion equipment is 1,000.

The power plant of the new vessel is extensive, consisting of two main generators, two auxiliary generators mounted on shaft extensions of the main generators and three independently driven auxiliary generators. All these generators are driven by Diesel engines, those for the main generators being built by the McIntosh & Seymour Company, two of the auxiliary engines being of Winton make and the other of Cummins manufacture. Practically all of the electrical equipment is of General Electric manufacture.

Matson Liner Malolo in Collision

THE Matson liner *Malolo* which left Cramp's shipyard on May 24 for her sea trials was rammed amidships off Nantucket the following day by the freighter *Jacob Christensen* in a dense fog. Both of the *Malolo's* boiler rooms were flooded and she was towed to New York for repairs by tugs of the Merritt-Chapman and Scott Corporation, arriving at that port on May 28. The bow of the *Jacob Christensen* was crushed but she was able to proceed to Philadelphia under her own power. No one was injured in the collision.



Matson liner Malolo leaving Cramp's shipyard on May 24 for her standardization and endurance trials at sea

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M. S. Augustus—The Largest Oil-Engined Liner

Particulars of the machinery arrangement in the quadruple screw, double acting engined, 32,000-ton passenger liner for the N. G. I. service between Italy and South America

By Our Special London Correspondent

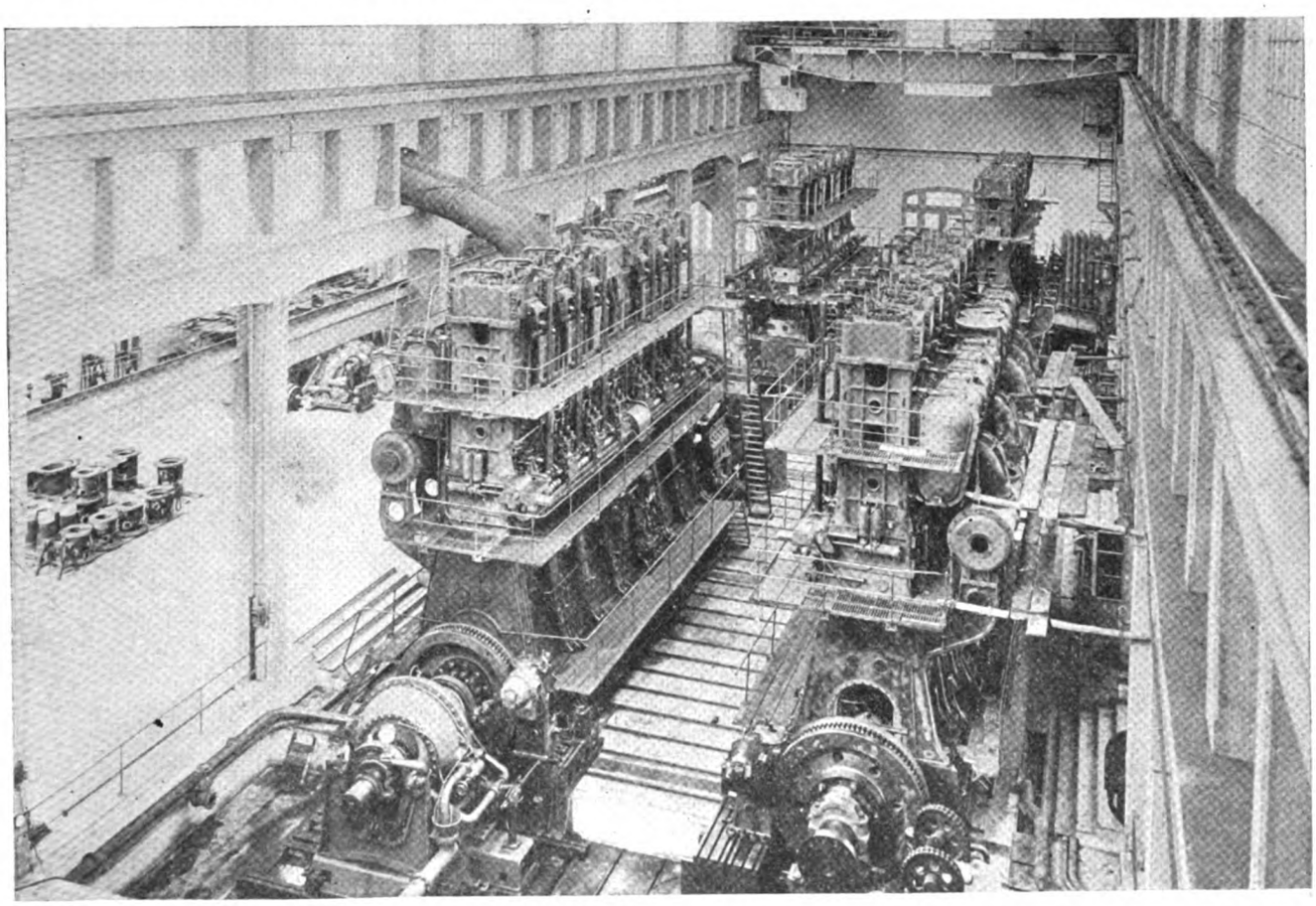
IN a recent article, some particulars were given of the machinery to be installed in the largest motor liner now building, the *Augustus,* and the engine room plans, which are now published, give an idea of the arrangement of the machinery as it will be installed in this vessel which is due for completion before the end of the year. The photographic reproductions also show the propelling engines erected at the works of the builders, the Cantieri Officine Savoia, who collaborated with the Maschinenfabrik Augsburg Nürnberg, Germany, in their manufacture. At the German works, some of the more important details were built, and the Italian firm supplied most of the heavy castings.

An examination of the plan reveals the somewhat striking fact, not perhaps surprising in view of the general adoption of electrical machinery, that the length required for the auxiliary engine rooms is greater than that of the propelling machinery space. There are actually, three compartments, separated by watertight bulkheads. Forward is the boiler room, and as the two boilers are required only for heating purposes and occupy little space, the wings are utilized for the installation of many of the ship's pumps. Next comes the generator room with its eight Diesel-driven dynamos and a few electrically operated pumps, and aft of this is the main propelling machinery. The total length is approximately 150 feet.

It may be recalled that the *Augustus,* which is a vessel of 32,000 tons gross, has to maintain a maximum speed in the neighborhood of 21 knots. In normal service, each of the four engines has to develop 6,250 brake horsepower at 120 revolutions per minute. The requirements are such that, when needed, this power can be increased to 7,000 shaft horsepower at 125 revolutions per minute for a period not less than 48 hours. It is obvious that, if an internal combustion engine can maintain a certain power for 48 hours, it could develop this output for a still longer period and the implication presumably is that, if necessary, the full power can be obtained from the engine for a week or more on end. The mechanical efficiency of the engines is 80 percent, so that the indicated horsepower is about 8,750 at the higher rating.

Main Propelling Machinery

The six cylinder engines are of the M.A.N. double acting, two stroke type, with cylinders 700 millimeters bore and a piston stroke of 1,200 millimeters and each is arranged to



The complete 25,000 brake horsepower Diesel installation of the liner Augustus erected in the builders' shop

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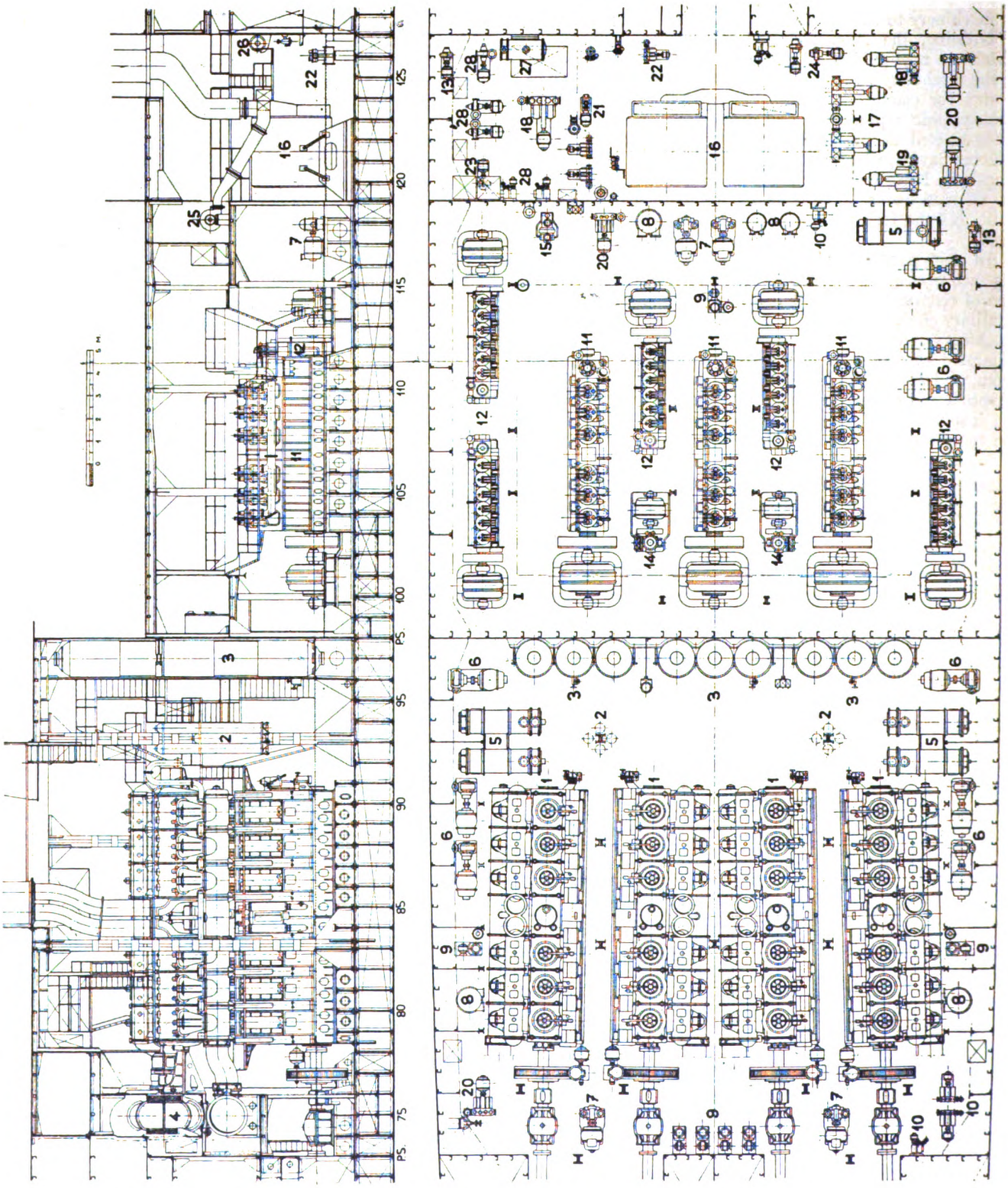
Machinery arrangement plans of the M. S. Augustus

KEY TO MACHINERY

1. Propelling engines.
2. Starting air reservoirs.
3. Injection air reservoirs.
4. Scavenging blowers.
5. Fresh water coolers.
6. Salt water and fresh water cooling pumps.
7. Lubricating oil pumps.
8. Lubricating oil coolers.
9. Fuel and lubricating oil separators.
10. Fuel oil pumps.
11. 600-kilowatt generators.
12. 300-horsepower generators.
13. Hot water pumps.
14. Electrically driven compressors.
15. Steam driven compressor.
16. Boilers.
17. Fuel pumps for pumping oil on board.
18. Fuel oil pumps.
19. Fresh water pump.
20. Fire and sanitary pumps.
21. Boiler feed pump.
22. Boiler fuel pump.
23. Drinking water pumps.
24. Fresh water pumps.
25. Forced draft fan.
26. Fuel oil heater.
27. Condenser.
28. Condenser pumps.



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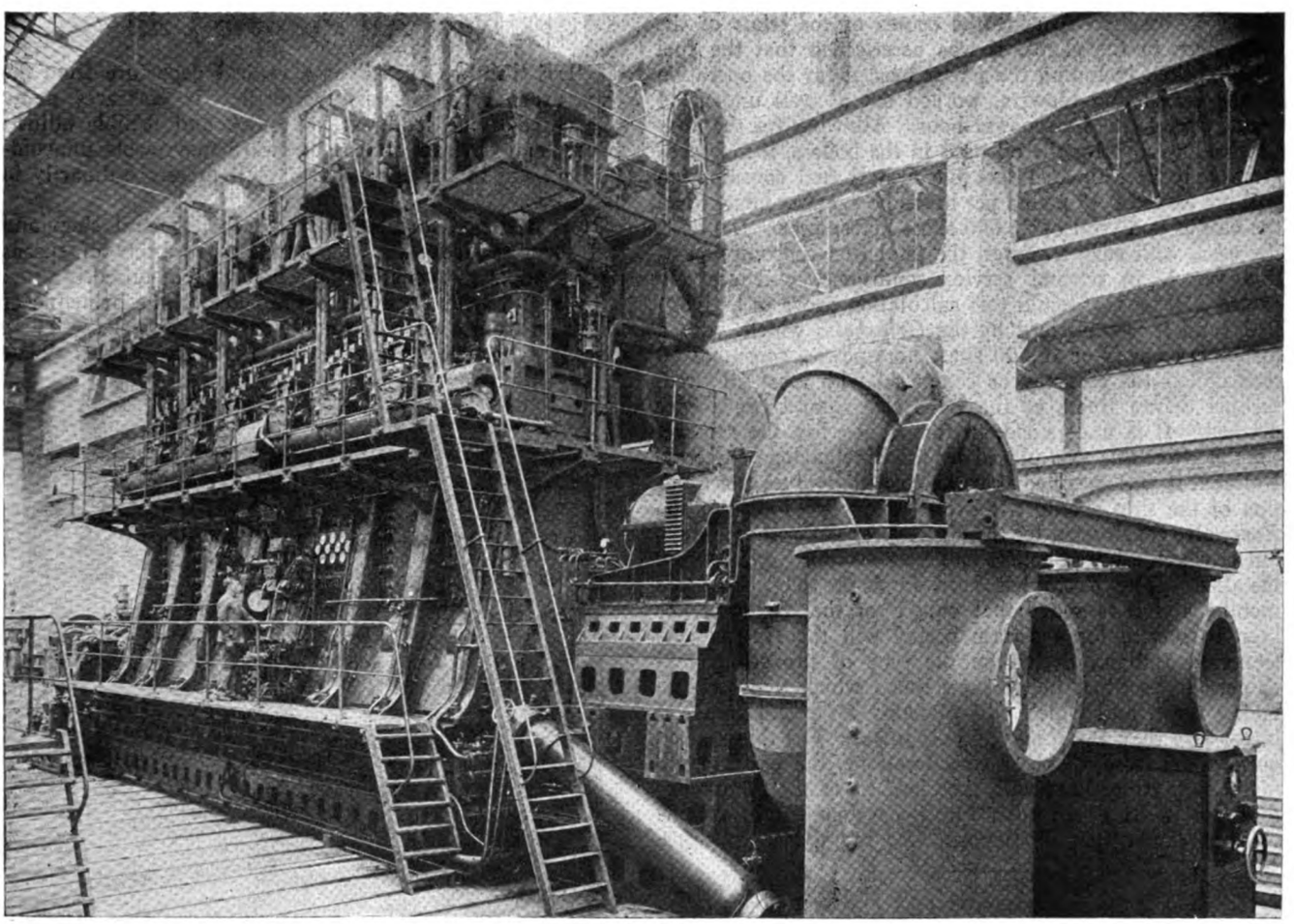

One of the 6,250 brake horsepower Diesel engines of the Augustus with electrically driven scavenging blower

drive its own air compressors, located between the two groups of three cylinders. In practically all details, these motors are similar to that which has recently been constructed by the Hooven, Owens and Rentschler Company, for installation in one of the converted steamers of the United States Shipping Board with, however, the notable difference that, in the American engine, the scavenging pump is driven directly off an extension of the crank shaft, whereas in the motors of the *Augustus* the scavenging air is supplied off electrically operated turbo blowers.

There are three of these blowers located at the after end of the main engine room, well above the floor, so that the outlet is on a level with the main scavenging trunks of the engines. Two out of the three units are sufficient to supply all the scavenging air needed for the four propelling engines, the third being a spare. The turbo blowers are of the Brown, Boveri construction, each driven by a motor with an input of 600 kilowatts and operating at a speed of 2,400 revolutions per minute. They are the largest machines of this class that have been constructed for installation on motorships.

Most of the M.A.N. double acting, two stroke engines which have been installed in cargo vessels have been arranged to operate with salt water circulation for cooling the pistons and cylinders. In the motors of the *Augustus,* however, arrangements are made for the utilization of fresh water, or alternatively, for sea water, the reason being that in some of the South American ports at which the ship will call, there is a liability of solid matter being contained in the adjacent waters. At sea, the salt water circulation system will, however, in general be employed.

At the forward end of the main engine room is arranged a somewhat imposing battery of air starting reservoirs, no fewer than 9 being fitted, all of exceptionally large size. There is very little other plant in the propelling engine room, apart from the various cooling water and lubricating oil pumps, and the coolers for the lubricating oil and fresh water, as well as a few other small machines.

Auxiliary Engine Room

Turning now to the auxiliary engine room, the arrangement is one of unusual interest. The adoption of no fewer than eight Diesel driven generators seems, at first sight, to be somewhat cumbrous, and unnecessary, but it has been thought desirable to install three units which should be utilized exclusively for the supply of power to the electric motors driving the turbo blowers. These are the larger plants arranged centrally, each comprising a six-cylinder 1,200 indicated horsepower Diesel engine coupled to a direct current 220-volt generator of 600 kilowatts. It will be noted that in normal service two of these dynamos will be required.

The remaining five generating sets comprise six-cylinder Diesel engines driving 300-kilowatt dynamos and these supply power for general ship's purposes and for operating all the motor driven auxiliaries in the engine room, apart from the turbo blower motors. The switchboard is fitted in the auxiliary engine room, at the after end, on a flat at the level of the top of the engines driving the dynamos.

Fuel Consumption

It is of some interest to estimate the fuel consumption of this large motor liner which will be considerably the biggest and highest powered oil engined motorship to be

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placed in service. During the course of the trials of the machinery in the shops, it was ascertained that the fuel consumption, including the power needed for the operation of the scavenging blowers, worked out at well under 0.4 pounds per brake horsepower hour. Allowing for the auxiliaries and also for the oil used in the boilers, it may conservatively be estimated that the overall fuel consumption will not exceed 0.45 pound per brake horsepower hour, when the output is a total of 25,000 shaft horsepower. If this is the case, with such a power, the total fuel consumption of this vessel, in normal service conditions, will scarcely exceed 120 tons. Should this calculation prove to be justified (and it is confirmed by the *Gripsholm* which, with a machinery power of 13,500 shaft horsepower, consumes 60 tons daily) the economy as compared with most oil fired, turbine driven liners of the same size should prove very marked. It is understood, in fact, that when the contract for the *Augustus* was placed by the Navigazione Generale Italiana, it was specified that the total daily fuel consumption of the ship should not exceed one-half of that of the *Roma* also constructed for the N. G. I. by the same builders, but in which oil fired boilers and Parsons type turbines were installed. The *Roma* has been in commission for some months and it is stated that only after the *Augustus* has been in service for a certain period will the Navigazione Generale Italiana decide on the type of propelling machinery to be fitted in two new liners which they propose laying down and which will probably be of substantially larger size than the *Roma* and *Augustus*. For this reason, quite apart from all other considerations, the performance of the new motor liner will, therefore, be of the utmost importance in its effect upon future development of marine internal combustion development for big passenger ships.

A Free Engineering Education

THE Webb Institute of Naval Architecture announces that on June 21 competitive examinations will be held for free scholarships.

The institute owes its existence to the generosity of William H. Webb, a great New York shipbuilder in the Civil War period. It was so liberally endowed that accepted students obtain not alone free instruction, but free board, lodging and laundry during their entire four years of training.

Primarily the instruction given is in naval architecture and marine engineering, but graduates are so thoroughly grounded in engineering studies that many of them enter the fields of electrical and mechanical engineering, and are filling many important places in these professions.

The board of trustees at its recent annual meeting announced that hereafter a post graduate course in aeronautics will be provided for those desiring the same by special arrangement with the Guggenheim School in the New York University, located within a very short distance of Webb Institute.

The trustees of this institute are leading men in the shipping industry, who give the institute their close attention.

To become eligible to enter this competition young men must be American citizens not less than 16 nor more than 21 years of age, have an education equivalent to the average high school requirements for graduation, and submit letters of recommendation as to character, etc. It is estimated that there are 15 vacancies to be filled.

Candidates in and about New York will be examined at the institute in Fordham, New York City. Candidates from other parts of the country may be examined at the nearest large city to their homes, by special arrangement.

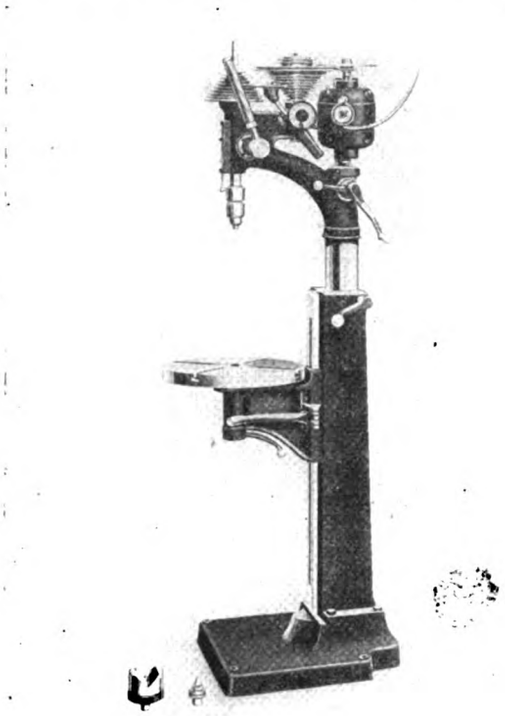
Applications should be addressed to the Dean, Webb Institute of Naval Architecture, 188th Street and Sedgwick Avenue, Fordham, New York City.

New All Purpose Drill

THE "Little General" is a radical departure from the usual type of sensitive drill. It embraces many time-saving features; has quick and flexible adjustments; and obviates all the awkward movements unavoidably present in the operation of drill presses ordinarily in use.

It is designed to meet every need of general shop and tool room service. Its wide range and variety of speeds readily adapt it to production work when required.

Belts and gears have been eliminated. The principle of the drive transmission is known as the "V-Disk." These disks are of fiber, tapered to an 18 degree angle. They



New type drive Ryerson drill

mesh with grooves disposed at a corresponding angle, thus effecting a substantially positive grip.

The spindle swings in a complete circle around the column, thus enabling the operator to reach large and heavy pieces in any position. The table swings in a semicircle and both the table and head have an unusually large vertical adjustment.

A direct reading speed shift dial indicates each of the 18 speeds and the size of drill best adapted to the various materials. Other advantages claimed for this new principle drill are—the long reach from drill to column; the small number of levers and working parts; the accurate depth gage graduated in both inches and millimeters; and the quick and convenient provisions for shifting and adjusting which reduce to a minimum the waste of time which is unavoidable in the use of many other drills.

The "Little General" has a drilling capacity, straight shank drills, of ½ inch. By using turned down shanks it is possible to drill one inch in brass or with care in iron.

Complete information can be secured by writing Joseph T. Ryerson and Son, Inc., Chicago, Ill.

TANKER TRAFFIC through the Panama Canal during April consisted of 127 vessels aggregating 711,276 tons.

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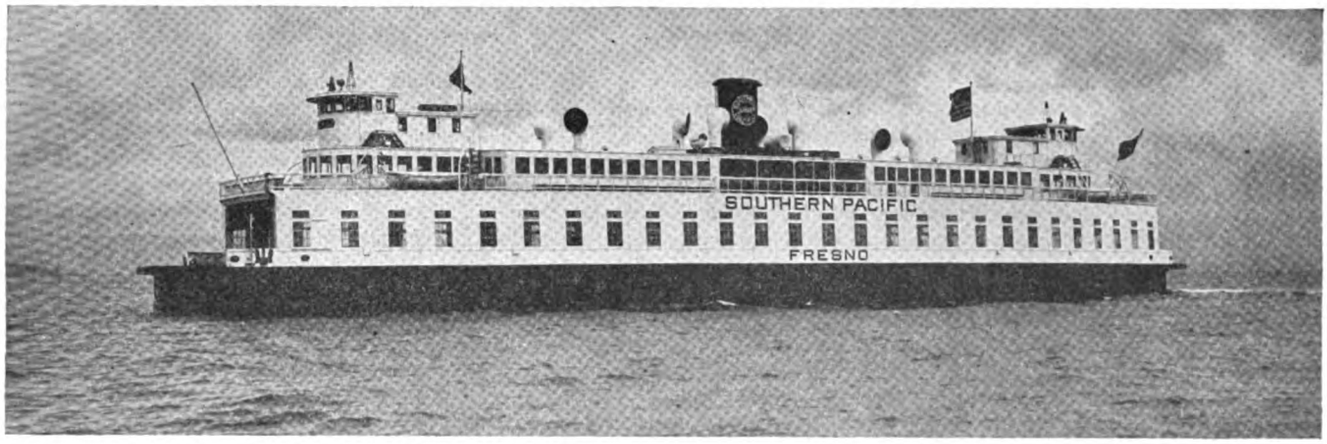

New Southern Pacific ferry boat Fresno

New Southern Pacific Diesel Electric Ferry Boats

First of the new vessels now in service between San Francisco and East Bay terminals—Others nearing completion to handle summer automobile tourist traffic

THREE steel hull Diesel electric driven automobile ferry boats, the first of their kind to be constructed, are being added to the fleet of transbay craft operated by the Southern Pacific Company on San Francisco Bay. One of these boats, the *Fresno,* has been completed and is now in service between San Francisco and East Bay terminals. She was launched at the yards of the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, on January 15, 1927, and had her official trial trip on April 9. The *Stockton,* second of the new vessels, was launched in the yards of the Bethlehem Company on March 5, and the third boat, the *Tahoe,* was launched by the Moore Drydock Company, Oakland, March 23. Both of these boats are rapidly nearing completion and will be in service on San Francisco Bay in time to handle the peak loads of the summer tourist travel across the bay.

The Southern Pacific Company operates an automobile ferry line, in addition to its passenger ferry service, from San Francisco to Oakland, Alameda, Richmond and Broadway street, Oakland. In 1926, the Southern Pacific Company carried more than 2,500,000 vehicles and more than 6,500,000 passengers on its automobile ferry boats.

General Arrangement

The boats are Diesel electric driven and the engines are of the Nelseco type built by the New London Ship and Engine Company, Groton, Conn., and furnished by the King-Knight Company of San Francisco. The engines develop 450 horsepower and, with four engines to each boat, provide a total of 1,800 horsepower to each boat.

The Southern Pacific Company has been increasing its service steadily and the three new boats will be of material aid in maintaining the present frequent schedules and in increasing the service if traffic demands.

The new boats are equipped with the Ward Leonard type switching and control system for a double pilot house and engine room control which permits the pilot to control the propelling power direct from the pilot house. All equipment in the boat is of the latest design and is the most modern marine equipment available. All the auxiliary equipment is electrically driven. The electrical equipment was supplied by the General Electric Company, Schenectady, N. Y.

Commodious women's and men's salons, a smoking room and a large, comfortable dining room, which is served by an electrically operated kitchen, are on the upper deck.

The hulls of the boats are of steel and every safety factor has been given thorough consideration in its construction.

The main power plant in each of these boats consists of four 450 brake horsepower Nelseco Diesel engines, each directly connected to a 275-kilowatt, 250-volt shunt wound, separately excited, direct current generator and, mounted on the same shaft, a 40-kilowatt, 125-volt, compound wound exciter. These units will deliver the rated power at 230 revolutions a minute. The generators operate in series, supplying current at 1,000 volts to the main propulsion motors which are of double unit type, shunt wound, and separately excited with forged flanged shafts. On continuous duty rating each of these motors will deliver 1,250 shaft horsepower at 100 to 130 revolutions a minute with 500 volts on each armature.

Main Engines

The Nelseco engines are of the vertical, 6-cylinder, 4-cycle, single acting, mechanical injection, full Diesel type, 15-inch bore by 22-inch stroke, each developing 450 horsepower at 230 revolutions per minute. The bed plate and housing extend the entire length of the working cylinders and are made of cast iron of extremely rigid design, the oil pan being cast integral with the bed plate. An angle section extends the entire length along each side. These are drilled for bolting to the foundations. Box sections which act as seats for the main bearing shells tie the two angle sections rigidly together. The housing extends upwards forming the crank case, and this part has large openings on either side opposite each crank. The top of the housing is faced off as it supports the cylinder block. The cylinder block, which is of cast iron, is bolted to the top of the crank case enclosing the top of it. The cylinder block is designed to allow ample cooling space around the cylinder liners, and space is also provided in the block for an air chamber for

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the air intakes, the openings of which are covered with slotted plates, the whole design being such as to silence the noise of the air intake.

The cylinder block and bed plate are held firmly together by large steel tie bolts extending the whole height of the engine and which take practically the whole combustion load, thus relieving the cast iron bed plate and cylinder block of this duty. The cylinder liners, which are simple cylindrical castings of special close grained cast iron, are machined on both sides, fitted into the block and held securely at the upper end, the lower being free to expand. A packing joint is provided at the lower end to prevent cooling water entering the crank case. The cylinder heads, of a special close grained cast iron, are provided with six cover plates, which may be removed for inspection or cleaning. Openings are made for the inlet and exhaust valves and the fuel nozzle. Special provision is made for the cooling water which is directed first at a high velocity across the under side of the head, as this is the hottest surface, and then at a lower velocity throughout the rest of the head. This system has proven especially efficient as it maintains the upper and lower surfaces at a more uniform temperature, thereby eliminating practically all distortion stresses and resultant fractures.

VALVES

The inlet, exhaust, air starting and safety valves, all of the poppet, spring loaded type, are carried in separate cages and so may be readily removed. Inlet and exhaust valves are interchangeable. The cam shaft is located at the top of and on one side of the crank case, being driven through spur gears from the crank shaft at one-half engine speed. It carries all of the cams for operating the inlet, exhaust and air starting valves as well as for operating the fuel injection pumps. The entire cam shaft assembly is enclosed by a sheet metal casing which retains the lubricating oil and serves as a guard.

The main bearings are of cast steel lined with bearing metal. The bottom half is a semi-circular shell, eccentrically machined so that it may be readily rolled out for inspection. The top half forms a solid cap. Shims are provided for adjustment. The crank shaft is of special carbon steel drilled for forced feed lubrication for the main and crank pin bearings. The forged steel connecting rods have a T-head for bolting to the phosphor bronze wrist pin bushing. The crank pin box is of cast steel lined with bearing metal and is in two parts with shims between. The connecting rod is drilled for the forced feed lubrication of the wrist pin bearings.

FUEL INJECTION PUMPS

Separate fuel injection pumps, operated from the cams on the cam shaft, are provided for each cylinder. The body of the pump is a solid block of steel, assuring tightness and strength, with drilled holes for the passage of the oil and for the valve chambers. The quantity of fuel delivered to the cylinder is governed by the by-pass valve located on the discharge side of the pump and controlled by the governor and hand throttle. The fuel oil flows from an overhead gravity supply tank, passing through duplex strainers before being supplied to the pumps. The fuel is forced from the pump through copper tubing to the fuel oil injection nozzle located in the cylinder head, which breaks the oil into a highly atomized form resulting in clean combustion without detonation or an excessive rise of cylinder pressure.

LUBRICATING SYSTEM

The lubricating oil system is extremely simple since the oil flows by gravity from an overhead supply tank to a header with distributing lines to each of the main bearings. From these bearings the oil passes through the drilled crank shaft to the crank pin bearings and from there up the drilled connecting rods to the wrist pin bearings. Separate lines from the main oil header lead to the cam shaft bearings and lubricate the cams and rollers. Oil draining down into the crank case is returned to the overhead supply tank by the lubricating oil pump which is attached to the engine.

Circulating water, lubricating oil transfer and fuel oil transfer pumps are attached to the engines and are of the vertical, single acting, plunger type. The speed governor is also driven from the crank shaft and acts directly on the fuel oil pump by-pass valves.

The overall length of these engines is 18 feet 9½ inches, with a width of 4 feet 8 inches, and an overall height of 10 feet 1½ inches. The gross weight is approximately 80,000 pounds.

Silencers for the engines are furnished by the manufacturers of the engines, and complete spares, under the American Bureau of Shipping requirements, are furnished with each boat.

AUXILIARIES

The auxiliary machinery is also furnished by King-Knight Company of San Francisco. A list of the auxiliaries on each boat is as follows:

One auxiliary generating set consisting of one 60-kilowatt, 125-volt, 1,150 revolutions per minute direct current generator mounted on a cast iron base with and driven through a flexible coupling by a Sterling model GRC, four cylinder gasoline engine developing 120 horsepower at 1,200 revolutions per minute.

An emergency fire pump unit consisting of one Northern rotary pump, capacity 500 gallons per minute against 125 pounds pressure. This pump will be mounted on a unit cast iron base with and driven through a flexible coupling by a 50 horsepower, 570 revolutions per minute, 125-volt, compound wound, direct current marine type continuously rated motor.

A fire and bilge pump unit consisting of one Northern rotary pump, capacity 500 gallons per minute against 125 pounds pressure. This pump will be mounted on a unit cast iron base with, and driven through, a flexible coupling by a 50 horsepower, 570 revolutions per minute, 125-volt, compound wound, direct current marine type continuously rated motor.

An air compressor unit consisting of one Gardner-Rix, 2-stage water cooled compressor with a capacity of 21 cubic feet per minute at 500 revolutions per minute. This compressor will be mounted with and driven by a 2 horsepower, 1,700 revolutions per minute, 125-volt, compound wound, direct current motor.

A hot water pump unit consisting of one Byron Jackson 1½ by 10 inch, 100 gallons per minute, 75-foot head, 1,700 revolutions per minute bronze fitted pump with monel shaft. This pump is mounted on a unit cast iron base with, and driven through, a flexible coupling by a 5 horsepower, 1,700 revolutions per minute, 125-volt, compound wound, direct current motor.

A sanitary pump unit consisting of one Byron Jackson 2 by 11-inch, 250 gallons per minute, 75-foot head, bronze fitted pump with monel shaft. This pump is mounted on a unit cast iron base with, and driven through, a flexible coupling by a 10 horsepower, 1,750 revolutions per minute, 125-volt, compound wound, direct current motor. All motors are furnished with remote control, push button starters, and all motors and starters are of the marine type with non-corrosive fittings.

CONTROL STATIONS

There are three control stations, one in each of the pilot houses and one in the engine room. The pedestal type controller in the pilot houses gives the pilot complete control of

(*Continued on page 332*)

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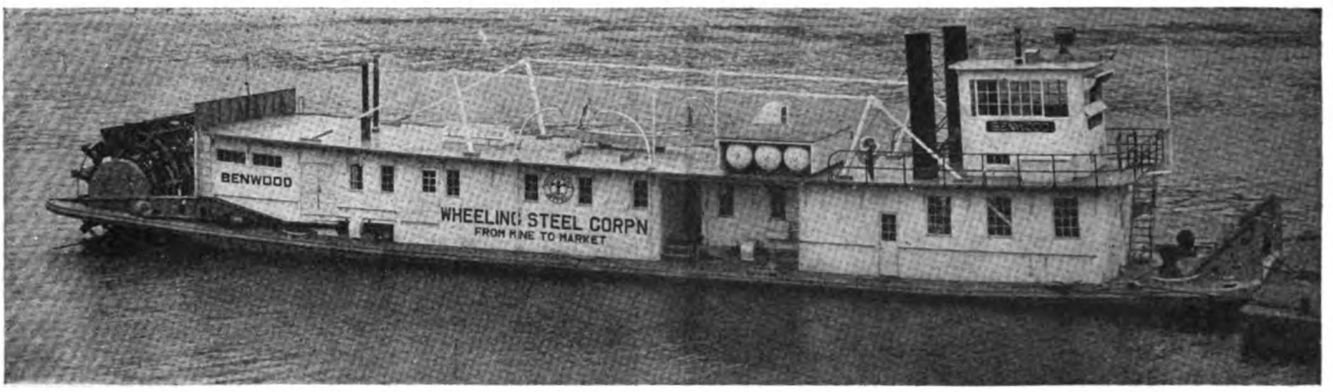


Motor towboat Benwood

New River Towboats Benwood and Betty

Steel towboats recently completed by the Dravo Contracting Company for the Wheeling Steel Corporation and the Keystone Sand and Supply Company are driven by two 240 horsepower Fairbanks-Morse Diesel engines

DURING the past few years there has been a very rapid development in shallow draft vessels for river service and a great improvement in both the design and construction of this type of craft. New river boats which illustrate the development work which is going on in this field are the towboats *Benwood* and *Betty* which have just been completed by the Dravo Contracting Company of Pittsburgh. The *Benwood* is owned by the Wheeling Steel Corporation of Wheeling, W. Va., and the *Betty* is owned by the Keystone Sand and Supply Company of Pittsburgh. A third boat now under construction has not been sold.

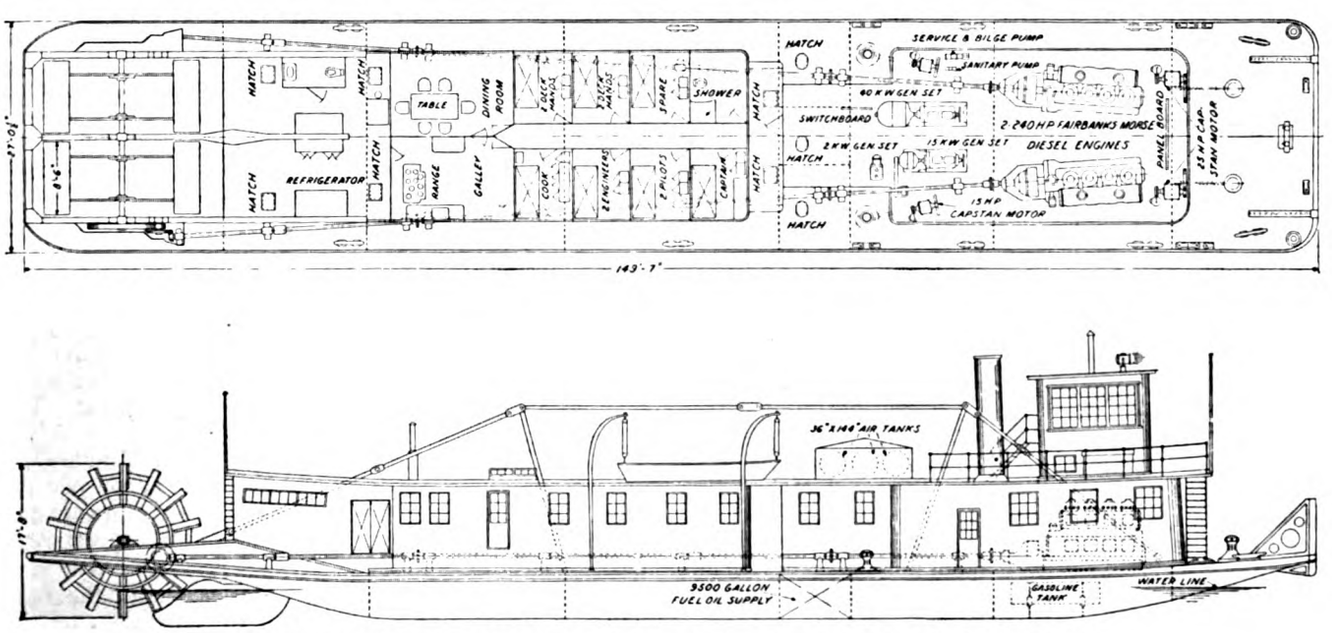
In the layout of these boats all of the latest trends in design are in evidence. These features are the use of all steel construction in both hull and superstructure; twin Diesel engine drives with each engine driving its section of the split stern wheel; unit type of reduction gear for the stern wheel drive and unusually complete pilot house arrangements.

Main Particulars

As shown in the illustrations of the *Benwood* this vessel is a trim craft with lines which are a considerable improvement over towboats of a few years ago. From the sturdy towing knees to the structure for supporting the split wheel the *Benwood* and *Betty* have a smoothness of line which indicates the care with which the design was laid down.

The boats have the following dimensions:

Length overall	149 feet	7 inches
Length, molded	126 feet	6 inches
Beam, overall	27 feet	½ inch
Beam, molded	26 feet	6 inches
Depth amidship	5 feet	6 inches
Crown of deck		6 inches



Profile and deck plan of towboat Benwood, showing arrangement of machinery

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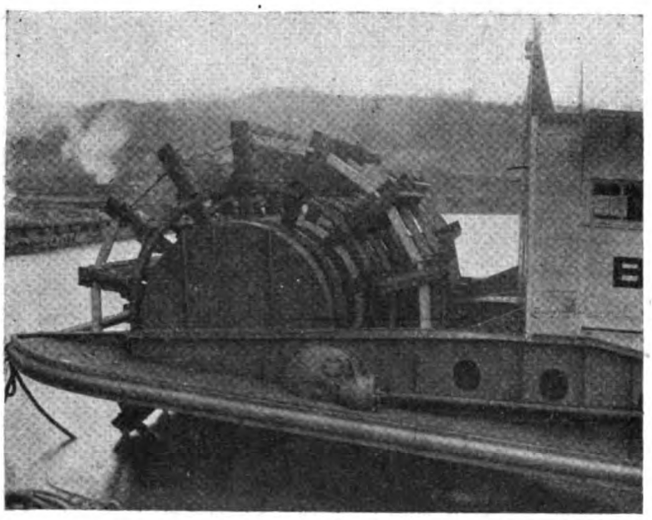
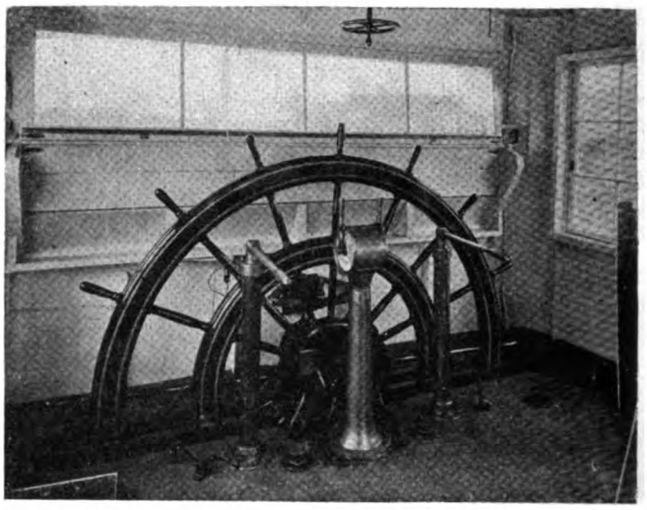
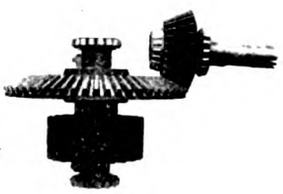


Stern wheel, showing drive shaft connection

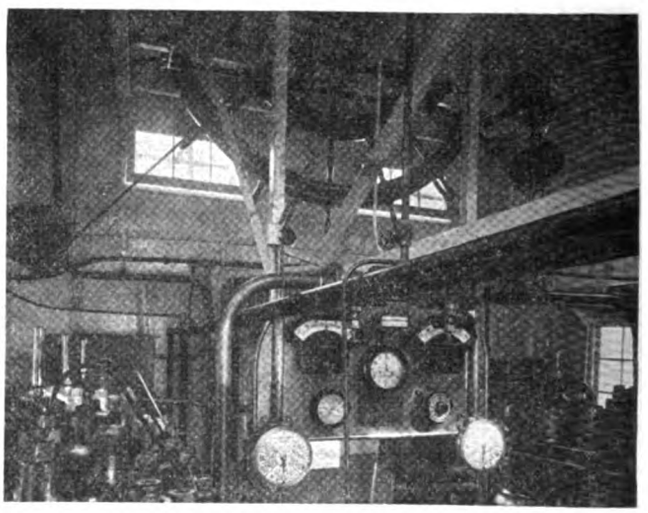


Pilot house

Stern wheel drive



Gear drive with housing removed



Forward end of engine room below pilot house

Recent trends in both the type of power and the arrangement of driving units are to be noted. The two 240 horsepower Fairbanks-Morse Diesel engines are each direct connected to a section of a split stern wheel. This use of two Diesel engines, each engine driving its own wheel, offers such unusual flexibility in operation and in maneuvering characteristics that much is to be said in its favor as compared with the use of a single engine of larger horsepower. Trial trips of the *Benwood* for instance demonstrated that with the rudders in the hard over position and with one engine operating one wheel in one direction and the other engine operating its wheel in the reverse direction it was possible to move the boat out from the wharf at right angles to the longitudinal axis of the vessel. Again by rotating the wheels in opposite directions and with the rudder set in its center position it was possible to pivot the boat on a point represented by the vertical axis of the stern wheel. These unusual maneuvering characteristics are particularly important in shallow draft work where it may be necessary to navigate unusually crooked streams.

Propelling Machinery

The two 240 horsepower Diesels are set slightly on an angle with the longitudinal axis of the towboat and are connected through air-oil operated clutches to 4⅞-inch drive shafts which are supported by ring oiling bearings. The sections of the shaft are connected together with DeLaval flexible couplings and the drive to the stern wheel is through a special unit type of reduction gear which has been developed and patented by the Dravo Contracting Company. This gear drive is quite interesting as it shows the great improvements which have been made in applying Diesel engines in river boat service.

The various solutions of the driving problem, of which this is one very fine example, is one of the reasons why the Diesel engine is being so rapidly adopted for river boat work. In this case the stern wheel drive consists of a bevel pinion which meshes with a bevel gear and on the bevel gear shaft is a pinion which drives a large spur gear which is keyed to the shaft of the stern wheel. The total reduction is 1 to 12.4 which, with a rated engine speed of 257 revolutions per minute, gives a speed at the stern wheel of 20 revolutions per minute.

The Gear Drive

The pinions are of forged, high carbon steel and are heat treated while the bevel gears of the two drives are carbon steel which has been forged and oil tempered. The large spur gears are of high carbon cast steel with cut teeth. All of the bearings in the stern wheel drive are Timken roller bearings arranged to take the radial and end thrust. The bearings supporting the stern wheel shaft are standard sleeve bearings, which are lubricated with an Alemite high pressure system so that it is unnecessary to climb over the stern wheel to screw up grease cups. The center grease gun which lubricates all these bearings is located at the stern of the boat.

Another interesting detail in connection with the stern wheel construction is a pipe which connects with the circulating water system on the engine so that it is possible

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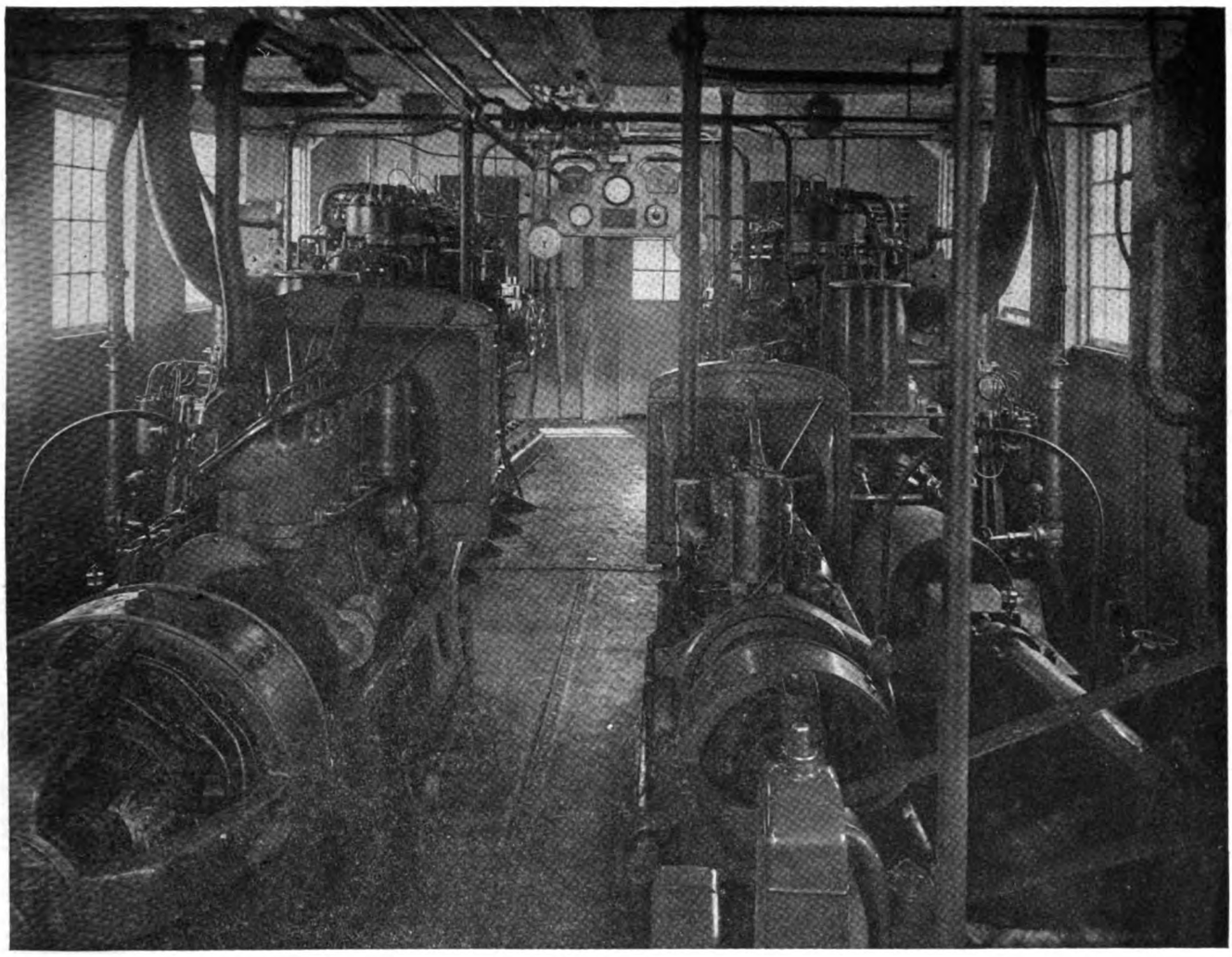

Engine room of the Benwood, looking forward

to discharge hot circulating water over the stern wheel in order to remove ice during winter operation.

Returning again to the engine room it will be noted from the illustrations that a centralized control panel is located just above the operating aisle between the two engines. This panel is equipped with two Brown electric tachometers which show the speed of the engine. There is also a pyrometer with its control switch mounted on the board. This control switch has eight points so that it is possible to read the operating temperatures of any of the cylinders of the two engines by this one indicator. A gage for the starting air pressure is also provided as well as a clock and the two engine room telegraphs are also mounted on this board.

The two 240 horsepower Diesel engines are equipped with built-in air compressors although these particular compressors are not standard compressors ordinarily furnished as a part of these engines. In this case the compressors are the two-stage intercooled type with a capacity of 90 cubic feet. The air pressure carried is approximately 200 pounds. The air supply is stored in three air tanks with a total capacity of 234 cubic feet. With the extra large compressors which are provided and the air tank capacity, the boats can meet the most unusual maneuvering conditions with a certainty that ample supply of air will be available.

The exhaust from the main engines is handled in each case by a copper exhaust pipe which attaches to the exhaust manifold of the engine and passes up to a water base which forms the base of each stack. This water base cools and cleans the exhaust and also has some silencing effect. The auxiliary units also exhaust into these water bases.

AUXILIARIES

One interesting detail connected with the Climax auxiliary gasoline engine units is the fact that these units, one of which is 60 horsepower driving a 40-kilowatt generator and the other 24 horsepower engine driving a 14-kilowatt generator, are radiator cooled. The explanation for this method of cooling is that these engines are frequently operated while the vessel is tied up at the wharf and it was desired to free the engineer from the necessity of looking after a circulating water system for the auxiliary units. The 24 horsepower engine is also belt connected to a 4½ by 5-inch auxiliary compressor as an adjunct to the regular air starting equipment.

Fuel oil is carried in three hull compartments which are formed by two oiltight bulkheads and two dividing partitions which split the compartment into three sections. The total capacity is 9,500 gallons which is sufficient for 30 days' normal operation.

Both the sanitary system and the bilge pump are air operated and the bilge pump connections are so arranged that any compartment can be pumped out.

Complete motor driven capstan equipment is provided, the two forward capstans being driven by 25 horsepower motors and the two side capstans with 15 horsepower motors. All these motors are of the heavy duty crane type with resistance control and are equipped with solenoid brakes.

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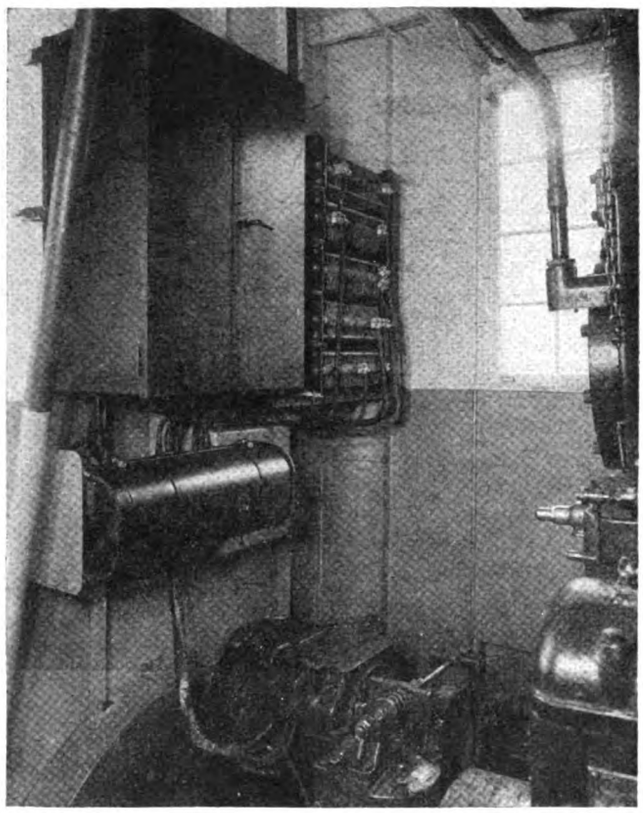
The type of motor used is very similar to those used on street railway cars.

The heating of the vessel is taken care of with a vacuum type vapor system using a Winchester Capital boiler which was supplied by the U. S. Radiator Company.

Reference was previously made to the fine maneuvering characteristics of the boats and one of the reasons why this is possible is due to the very complete arrangement of the pilot house equipment. The first detail that strikes the observer entering the pilot house is the fine black walnut wheel of the two circle type. This wheel is inlaid with maple and is in itself a very fine example of skilled craftsmanship. Directly behind the center of the wheel is located the double control Cory engine room telegraph, one side for each engine, and the two steering columns are located on each side of the telegraph pedestal.



Capstan motor equipped with solencid brakes and resistance control

Through a very interesting linkage arrangement the two levers on the steering columns not only control the opening of the air valve which admits air to the Western River ram type of steering engine but also releases the brakes which lock the wheel. Four foot pedals have also been provided as shown in the view of the pilot house, which are automatically raised as soon as either of the steering levers are thrown into a position where the valve which admits air to the steering engine is opened. Two of these foot pedals are located near the side windows and so it is easy for the pilot to stop the movement of the rudders by stepping on the foot pedal which is next to him. When any one of these four foot pedals are depressed the brake is applied to the wheel. As long as the steering levers are in the operating position the steering engine continues to move the rudders over unless stopped as mentioned. A tiller indicator operated from the wheel drum shows the course of the vessel.

There are three balanced rudders built of 3¾-inch white oak securely drift bolted together and reinforced with plates and bars. The rudders also have a fin plate about 24 inches wide at the aft end tapering to the width of the angles at the rudder stock. The rudder trunks are 9-inch extra heavy pipe and both the lower and upper bearings are bronze bushed.

There are also two foot pedals in the pilot house which control the Strombos triple gong whistle. On the roof of the pilot house is a 19-inch searchlight which is controlled by a hand wheel just above the pilot's head. With this control it is possible to swing this searchlight both vertically and horizontally so that the beam can be focused at any point desired.

ACCOMMODATIONS

The layout of the *Benwood* and the *Betty* shows that considerable thought has also been given to the comforts of the crew. The quarters are well arranged and include 6 rooms and bath room. The complete equipment of the galley includes a Kelvinator refrigerating unit. Current for operating the refrigerator is supplied by a 2,000-watt Kohler generating set located in the engine room. This set is of the automatic type and is connected to the circuit connecting the night lights. Whenever the thermostatic switch on the refrigerating unit closes or when one of the night lights is turned on the set starts up automatically. The flooring in the quarters is covered with 3/16-inch battleship linoleum laid with cement.

The complete design of the *Benwood* was developed by the Dravo Contracting Company, of which F. R. Dravo is president, V. B. Edwards is vice president and general manager and R. N. Coolidge is assistant general manager.

New Southern Pacific Ferry Boats

(*Continued from page 328*)

the ship. With this control the pilot is able to govern the speed of the ship and the direction of travel. In going in a definite direction the speed of the boat is controlled by the pilot in the forward pilot house. At the end of the trip the control is reversed to the other pilot house by the engineer in the engine room. In case it is necessary or desirable to control the boat from the engine room this can be accomplished by switching the control to the station in the engine room, and the signals from the pilot house can be transmitted by means of the engine room telegraph.

There is located in each pilot house, and in the engine room, revolution indicators which will at all times indicate the speed of the forward and the aft propellers, giving the pilot a very close check upon the speed of the boat.

The main propulsion control switchboard is located in the engine room, and so arranged that no live parts are exposed. The auxiliary generator is controlled from a separate switchboard in the engine room, and the separate exciter switchboard is so arranged that one exciter may be used for excitation of the main drive generators and motors, and any two for furnishing power to the auxiliaries, leaving one exciter as a spare.

Each of these three ferry boats is equipped with two Cunningham straight electric steering gears arranged for independent control of each rudder from the pilot house through Sperry telemotors.

CORRECTION.—In the article on The First Pulverized Coal Installation on Board Ship, published on page 278 of our May issue, it was stated that "On this ship (the Shipping Board steamer *Bellepline*) will be installed Kennedy airswept tube mill pulverizers." We are advised that the selection of pulverizers for this purpose will not be made until the results of the tests on the *Illinois* have been analyzed.

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Performance of Lake Freighter Steel Electrician Shows Advantage of Diesel Electric Propulsion

Vessel equipped with Diesel electric machinery makes more trips and carries more cargo than direct Diesel driven sister ships

By H. C. Coleman*

REPORTS of the United States Steel Products Company on their lake freighters show that the Westinghouse Diesel-electric driven *Steel Electrician* has made more trips and carried more cargo per trip during her first season than any of her direct Diesel driven sister ships, although she has a slightly smaller total shaft horsepower. And in further comparison with these motorships, indications are that the total fuel consumption of the *Steel Electrician* has equaled or bettered that of any of them. In fact, the vessel has been so satisfactory in all respects it is anticipated that she is the forerunner of more lakers fitted with Diesel-electric drive.

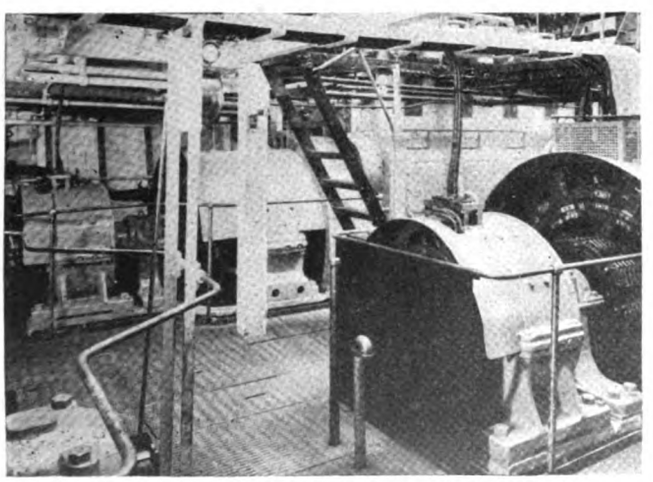
The *Steel Electrician,* although not nearly as large as the lake ore carriers, because of the dimensions of the locks of the Welland Canal through which she must pass in her regular trade, is constructed along similar lines in that the propulsion machinery is all located as far aft as possible, with an after deck house for the engine room force, and with the wheel house and quarters for deck officers and deck hands forward. The vessel is designed for carrying steel plates, rails and structural shapes, and is, therefore, provided with two large cargo hatches, each 40 feet by 20 feet, and each opening into a cargo hold about 80 feet long. Special provision is made for handling the cargo, much of which is in very large pieces, by two 5-ton electric revolving cranes, similar to the usual land locomotive crane, which replace the usual deck winches. The vessel is unique in this respect, along with its sister ships, the *Steelvendor, Steelmotor,* and *Steel Chemist.* These vessels are all of the same size except for a few inches in the overall length, and are practically duplicates in all details except for machinery arrangement. Each of the first two above named ships is propelled by a 750 shaft horsepower, 135 revolutions per minute, six cylinder, 4 cycle, air injection Diesel engine, while the *Steel Chemist* has a 950 horsepower, 165 revolutions per minute, six cylinder, double acting, air injection, Diesel engine.

*Marine Engineering Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

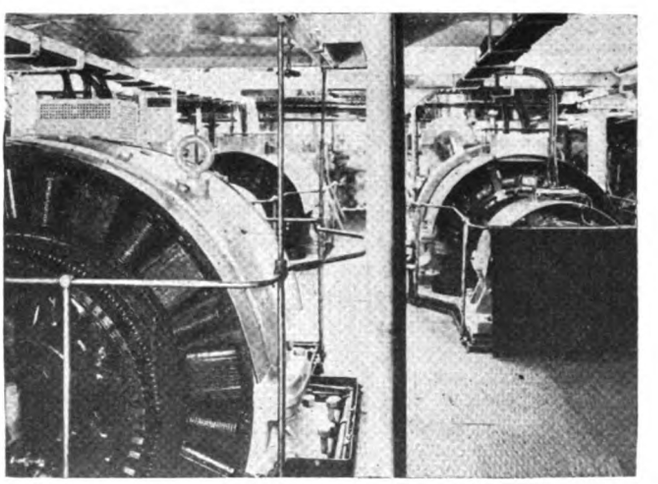
The following are the chief characteristics of the *Steel Electrician:*

Length overall	257 feet	11⅝ inches
Length between perpendiculars	250 feet	
Beam, molded	42 feet	9 inches
Depth, molded	20 feet	
Load draft (Lake service)	14 feet	
Gross tonnage	1,694	
Net tonnage	974	
Number of main engines	3	
Shaft horsepower	750	

The *Steel Electrician* and her sister ships were designed and built by the Federal Shipbuilding and Drydock Company, Kearny, N. J. For the *Steel Electrician,* the builders chose three 300 horsepower, 225 revolutions per minute, 4 cylinder, 4 cycle, airless injection main Diesel engines of the new M.A.N. type as manufactured by the New London Ship and Engine Company, Groton, Conn., and complete electrical propulsion equipment and underdeck auxiliary motors and control built by the Westinghouse Electric and Manufacturing Company. Each main engine drives a 205-kilowatt, 230-volt, main generator and a 30-kilowatt, 230-volt exciter. The main generators furnish power to the 750 horsepower, 690-volt, 135 revolutions per minute, single unit propulsion motor. Each engine, generator and exciter is mounted on a cast base, and a heavy duty pedestal bearing is fitted between the generator and exciter, with the exciter armature overhung. This arrangement makes a very compact unit and one which is easily handled, in installation. The three generating sets are arranged abreast of each other with the center set moved forward slightly to make room for the propulsion motor. The switchboard is located on a platform directly above the motor, thus affording the switchboard attendant a complete view of all the main machinery. As will be seen from the illustrations,



Main engine, generator and exciter



Engine room, looking forward

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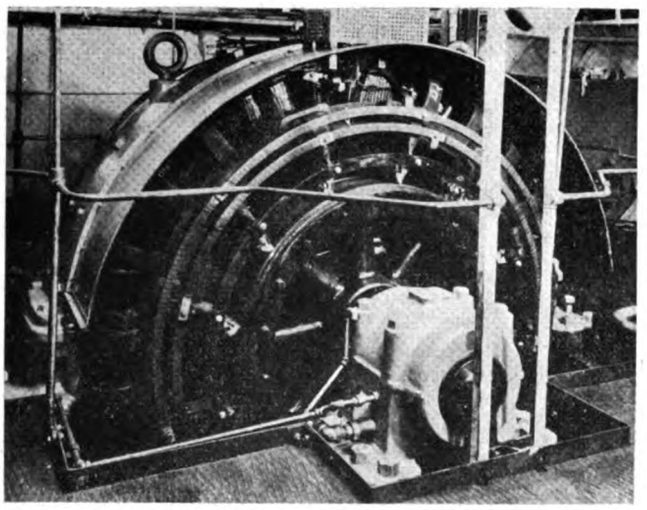


750 horsepower propelling motor

this gives a very spacious and clean cut engine room with easy access to all parts of the machinery.

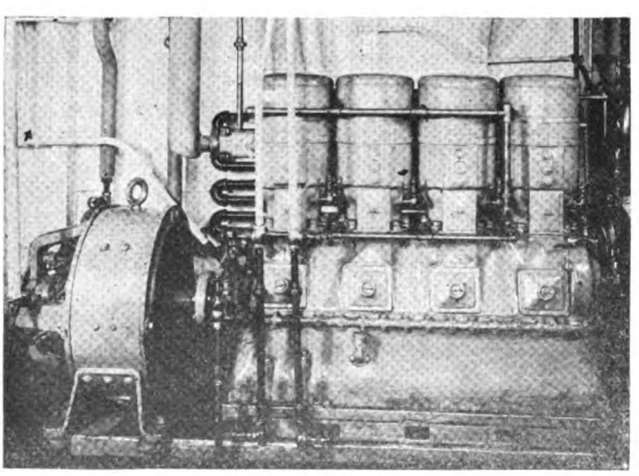
The main generators, exciters and propelling motor are of the open, self-ventilated type, but are fitted with sheet steel covers to protect them from dripping or mechanical injury. The main generators and propelling motor are straight shunt wound machines, connected in series and arranged for the full voltage control system, which the Westinghouse Company has used on the large number of vessels it has equipped with Diesel electric drive. A very simple potentiometer type rheostat is used for varying the generator field excitation in 50 steps from zero to full value in either direction. The motor field is excited at constant value and in one direction. Under this condition, a variation in the generator excitation will produce a like variation in the motor speed, and hence the propeller speed. Complete control of the propeller is, therefore, effected from the pilot house by handling only the small field current of the generators and without opening a circuit of any kind. The potentiometer rheostat is mounted just beneath the pilot house floor and is operated, through bevel gears and shaft ing from a control pedestal, similar to a standard engine room telegraph stand, located in the pilot house alongside the steering control stand. A duplicate control station is provided at the switchboard in the engine room for emergency use. Complete control may be instantly transferred from one station to the other by manipulation of a switch on the main switchboard.

As shown in the illustrations, the main switchboard is arranged in six panels. The three panels on the port side control the connection set-ups for the main generators, and are of the complete dead-front type. Each generator is provided with a 3-position switch, manually operated by means of a hand wheel on the front of the panel The hand wheel is provided with a notched disk so that the switch may be latched in any one of the three positions. Each latch handle carries an interlock which opens the excitation circuit to the generator and motor fields whenever the latch is disengaged from the notch, thus assuring that the main circuit is de-energized whenever switching operations are made. One position of the switch connects the generator in the series propulsion circuit. The second position on the switch connects the generator to the auxiliary bus for supplying the cargo handling machinery. The third position disconnects the generator from all active circuits and at the same time completes the series propulsion circuit for the remaining portion of the plant when set up for propulsion. The proper field circuit connections are also effected by the set-up switch in the various positions An interlock is also provided to prevent connecting more than one generator to the auxiliary bus simultaneously The hand wheel at the top of the center panel of the dead-front propulsion group operates the engine room potentiometer rheostat for emergency control of the propeller. The switch handle at the bottom of the same panel connects the control to either the pilot house potentiometer rheostat, or to the one in the engine room.

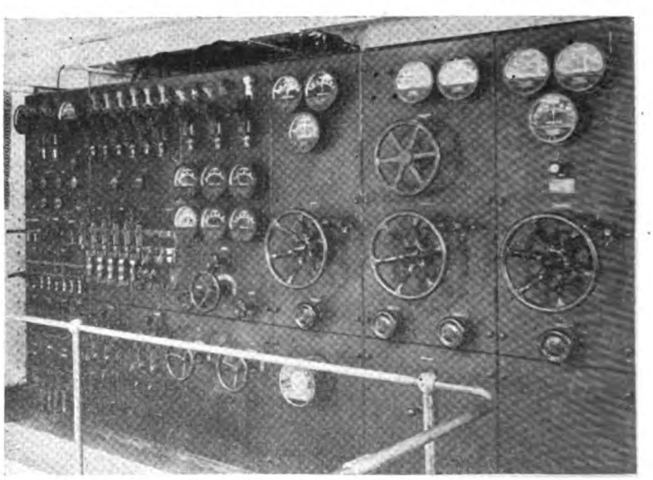
From the above, it is obvious that the control is arranged so that any combination of main generators may be used for propulsion. Also the voltage control system, as installed, makes it possible to utilize the full engine capacity of any number of sets in operation. Thus, with two of the three generating sets in operation, there is sufficient power to drive the vessel at 88 percent speed, while one of the generating sets will furnish sufficient power to drive the vessel at 70 percent speed. This makes an exceedingly flexible propulsion plant.

The ability to use any one of the main generators for supplying power to the cargo handling machinery is another important point in the flexibility of the system. This arrangement eliminates the large auxiliary generating sets which are required with the direct Diesel drive. The *Steel Electrician,* therefore, carries only a small auxiliary oil engine generator set of 15 kilowatts capacity which is used chiefly when the vessel is laid up.

The *Steel Electrician* is the first vessel to be fitted with an automatic power limit control. The function of this part of the equipment is to limit the power developed by the engine to a predetermined value in order to prevent detrimental overload. The power limit control operates in



15-kilowatt auxiliary generating set



Main control panel

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such a manner as not to interfere in any way with the maneuvering of the vessel.

The arrangement of auxiliary busses and method of supplying these with power as worked out on this installation is very novel and interesting. There are five auxiliary busses and the loads connected to these busses and the arrangement for feeding them with power is as follows:

Bus "A" supplies excitation, lighting and steering gear power. This bus may be energized from any one of the three exciters.

Bus "B"—auxiliary power to engine room auxiliaries. This bus may be energized from any one of the three exciters or from the auxiliary power bus "C," which, in turn, may be energized from auxiliary power bus "E."

Bus "C"—power to engine room auxiliaries. This bus may be energized from any one of the three exciters or from auxiliary power bus "E."

Auxiliary Bus "D"—auxiliary power to engine room auxiliaries. This bus may be energized by the 15 kilowatt auxiliary generator.

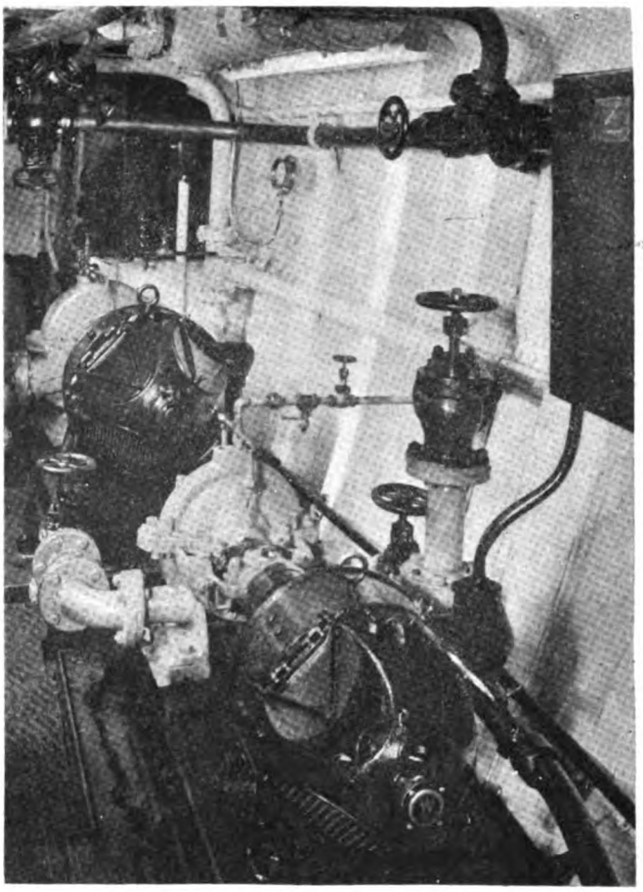
Bus "E"—auxiliary power to cargo handling and other deck machinery, and power to bus "C." This bus may be energized from any one of the three main generators.

The arrangement for connecting the three exciters to the busses, as mentioned above, consists of three hand wheel operated cam contactor switch groups, these groups being mounted back of the fourth panel of the main switchboard from the port side, and operated from hand wheels on the front. Each group provides for connecting that particular bus to any one of the exciters. The system is such as to prevent paralleling the exciters. This provides complete flexibility of the auxiliary plant in a simple yet fool-proof arrangement. The engine room auxiliary feeder switches are made double throw connecting to either of two of the auxiliary power busses, so that it is possible to divide the auxiliary load, when under way, between the three exciters. This makes it possible to utilize the full capacity of the three exciters when necessary, and also makes it possible to equalize the auxiliary load on the main engines.

In order to provide for the 115-volt lighting bus, radio, etc., there are provided two motor generator sets, each consisting of a 7-kilowatt, 125-volt generator driven by a 14 horsepower, 230-volt motor. Normally one of these sets provides sufficient power, thus leaving one unit for a spare. These sets are controlled so that power may be taken from the auxiliary power busses in such a way that the 115-volt circuits may be energized, regardless of the source of power on the auxiliary busses.

All of the underdeck auxiliary motors are of the latest drip-proof, self-ventilated, marine type, and were supplied by the Westinghouse Company. The controllers supplied by the same company are both of the magnetic contactor and hand-starting and speed-regulating types, all enclosed in marine type, drip-proof cabinets.

It has been found that one of the chief advantages of the *Steel Electrician* over her sister ships is the flexibility and positive control available with the full voltage control system operated from the pilot house. This system affords the highest refinement of control, and at the same time utilizes the simplest arrangement of apparatus and of electrical circuits. An indication of the refinement of control is shown by the fact that on the *Steel Electrician* the speed of the propeller may be varied directly from the pilot house in 50 progressive steps of less than 3 revolutions per minute each from the "Stop" position to full speed of 135 revolutions. This range of control is, of course, available, either ahead or astern. The ability to regulate the speed directly from the pilot house in such small increments and over the entire range affords a marked improvement over the direct Diesel driven ship where it has been found impossible to get down to speeds as low as desired, even when cutting out 3 of the 6 cylinders during this operation. This will readily show why the *Steel Electrician* during her past season's



Circulating water pumps

operation has made much better time through the canal and other restricted places than her sister ships.

The captain of the *Steel Electrician* operates the vessel in a manner similar to a driver operating an automobile. There is no guessing or waiting for signals to the engine room to be executed. The fact that the captain controls the vessel himself eliminates most of the hazard of navigating the canal locks and restricted places. This feature alone should be valuable in reducing the chances for damage to both the vessel and the locks.

The growing popularity of this type of drive is evidenced by the fact that we now have Diesel-electric yachts, trawlers, tugs of all kinds, ferry boats, fire boats, seagoing and other types of dredges, sternwheel river boats, tankers, Coast Guard cutters and ocean-going cargo vessels. Up to the present time, there has been installed (or contracted for) in this country a total of 72 Diesel-electric propulsion plants, ranging in size from 60 to 3,200 shaft horsepower, with a total shaft horsepower of 52,105. These figures indicate that electricity has quickly become an important factor in the field of ship propulsion, as it has in every other field of application when once introduced.

MORE PRIVATELY OWNED AMERICAN SHIPS IN SERVICE.—A greater number of privately owned American vessels are now in active service than at any time during the preceding year, according to records of the Bureau of Research, United States Shipping Board. At the present time these total 1,098 vessels, of 5,516,400 gross tons. In this connection it is noted that on April 1, 1926, there were only 77 privately owned American general cargo carriers of 429,300 gross tons in operation in the overseas foreign trade, while at the present time the privately owned American fleet engaged in that trade includes 117 general cargo carriers, with an aggregate of 638,800 gross tons.

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Erosion of Surface Condenser Tubes*

Investigations show that turbulent motion of water in the water box may be one of the chief causes of erosion

By Sir Charles A. Parsons

THE problem of the failure of the tubes of surface condensers is so well known that it seems only necessary here to allude to a few of the salient facts bearing upon the question. While no adequate explanation has as yet been assigned for such failure, many attempts have been made to overcome it. On the theory that it is caused by electrolytic corrosion, counter-electromotive force has been applied to neutralize the action; on the theory that it arises from chemical action, such means as coating the inside of the tubes with a bituminous paint or with a protective scale of oxide have been tried. None of these measures has proved to be more than palliative in its effects, and sometimes not even that. In a few cases more expensive metals are being adopted for the tubes, such as cupro-nickel or monel metal. For many years bell-shaped mouths have been fitted to the inlet ends of condenser tubes to produce a smooth stream-line flow into the tubes,† and this is claimed to prevent the formation of a *vena contracta* by the sharp square entrance to the tube and the liberation of oxygen and other occluded gases from the water which cause corrosive action at the tube entrance.‡

In most cases of failure it has been observed that certain of the tubes are eroded, corroded, pitted, and eventually holed, but always or nearly always from the water side, that is to say, from the inside surface. The action is usually confined to tubes in certain regions of the condenser tube plate, and if such tubes are replaced from the common batch they have usually failed just as quickly, while in other positions in the tube plate the original tubes have remained immune, so that there appear to be distinctive areas in which the conditions favor corrosion or erosion. Further, it appears that the action is greatest at the entry ends of the tubes, frequently extending only a few feet from the mouth. These facts seem to suggest that the cause may be

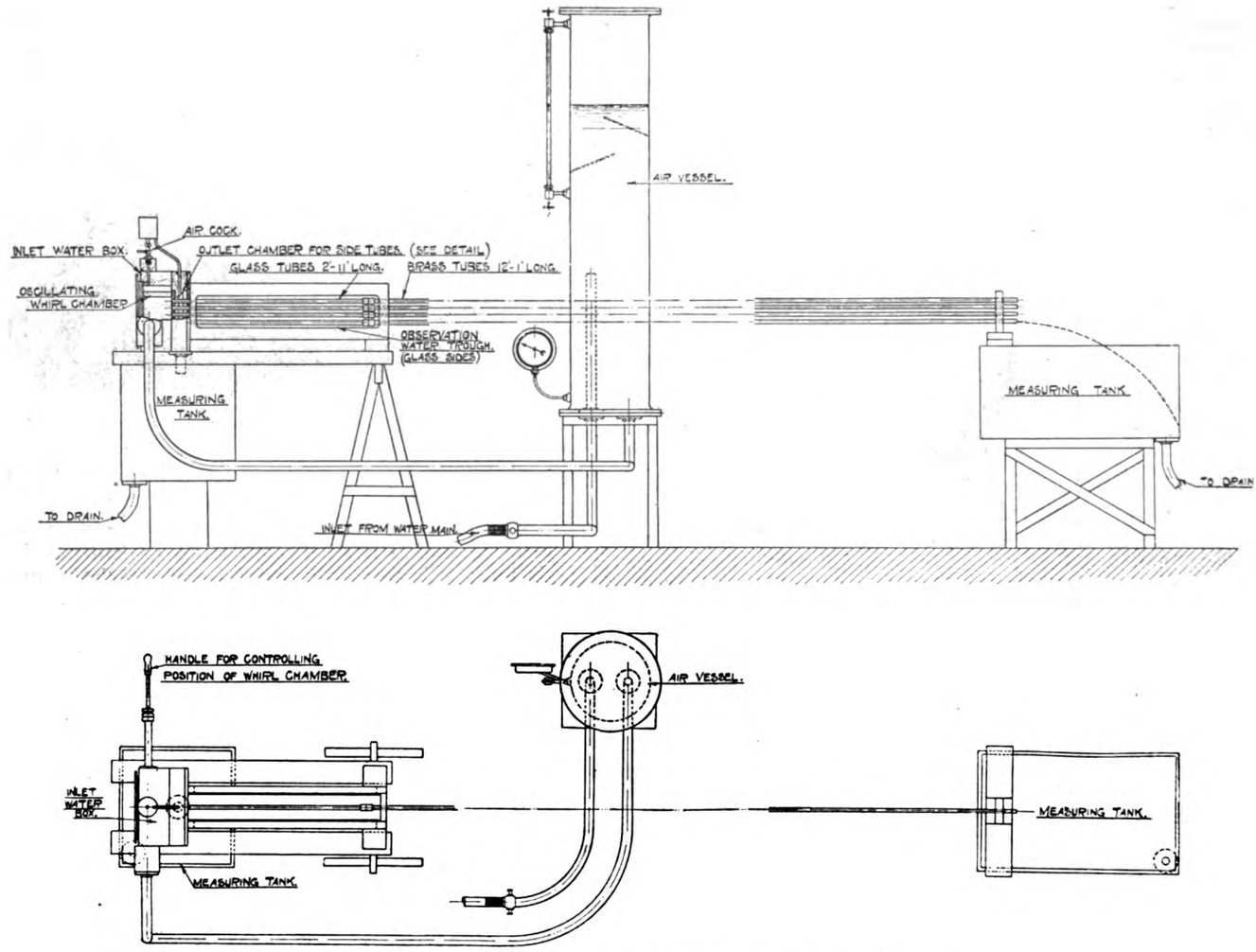

Fig. 1.—Apparatus for demonstrating vortex motion at tube entry

* Paper read at the spring meetings of the sixty-eighth session of the Institution of Naval Architects, London, April 6, 1927.

† Vide P. C. Parker's remarks in the discussion on Dr. Bengough's paper, *Transactions of the North-East Coast Institution of Engineers and Shipbuilders*, Vol. XI., Part 2, 1923.

‡ Vide Serial Report of the Prime Movers Committee, 1926-27, of the National Electric Light Association of New York, U. S. A.

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hydro-dynamical rather than electrical or chemical, and in the light of the experiments described in this paper they seem to indicate that these areas of erosion or corrosion are associated with regions of turbulent motion of the water in the water box.

The object of the present paper is to give an account of some experimental investigations which have been designed to throw light upon the actual conditions attending such regional disturbances in the water box, and the manner in which they affect the character of the flow through the tubes in their vicinity, also to investigate the possibility that the pitting of condenser tubes may in reality be due to water hammer of collapsing vortices, which is known to be a potent cause of erosion of screw propellers and of the impellers of centrifugal pumps and water turbines.

A paper was read before the Institution in 1919 by the present author and Mr. Stanley S. Cook on the "Cause of Erosion of Propellers." The paper recounted the investigations carried out by the Propeller Erosion or Corrosion Committee of the Board of Invention and Research. In that paper experiments with a water hammer cone were described, in which it was shown that by concentrated collapse of a vacuous cavity in water under atmospheric pressure small holes could be punched through brass disks, demonstrating the production by this means of shock pressures as high as 150 tons per square inch. The conclusions of the Committee were that the powerful and erratic erosion experienced with propellers was due to vacuous cavities in the water arising from eddies caused by struts or bossing, or by excessive slip of the propeller itself, which cavities collapsing on the surface of the propeller blade caused repeated blows and erosion of the metal.

The first of the present experiments was designed so that the behavior of the water in the water box and also in the tubes could be observed and, if desired, photographed.

The apparatus shown in Fig. 1 was constructed. It consists of a small wooden water box, the front being of plate glass, with a brass tube plate for ten tubes. To facilitate observation the first 3 feet of the four tubes of the central vertical row were made of glass also, the tubes of the side rows were omitted, and instead retarding plugs were fitted giving the same discharge as a 15-foot length of condenser tube. The discharge from these side holes was led into a separate chamber immediately behind the tube plate. The four central glass tubes passed through the back of this chamber, and were joined at their ends by clamped rubber tube couplings to brass tubes 12 feet long, making a total tube length of 15 feet. They were also surrounded by a rectangular water tank with plate glass sides so that (the refractive index of glass and water being nearly the same) the water inside the tube could be seen without appreciable refraction. The discharge from the long tubes was taken into a measuring tank with a glass front, so that the trajectory of the water issuing from the tubes could be observed.

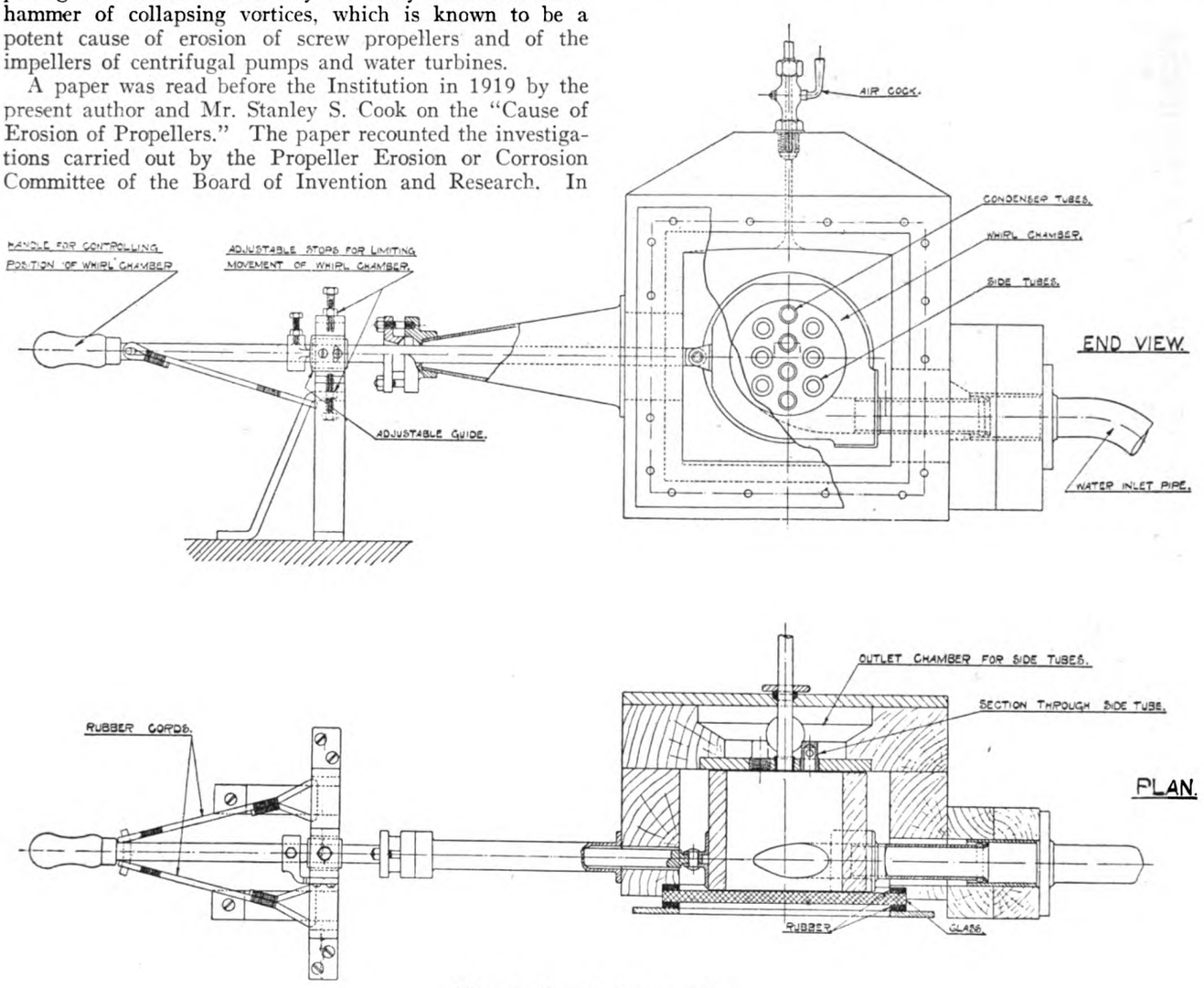

Fig. 2.—Detail of water box

Closely fitting between the front plate glass of the water box and the tube plate, an inner and movable water box of circular shape was fitted into which the water was led tangentially through a socket fitting. This inner water box was moved by a lever passed through a stuffing box, guides and stops as shown in Fig. 2 controlled its motion, so that it could be moved up and down across the face of the tube plate. An air vessel on the water supply to the

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box maintained a steady pressure of about 10 pounds per square inch. With water entering the water box at a speed of 8 feet per second, which was also the speed of the water through the tubes, a vortex filament was observable near the center of the circular inner box, extending across from the glass plate to the tube plate. By moving the box this vortex could be brought over the mouths of tubes Nos. 2 and 3 of the four central tubes, the tubes No. 1 and No. 4, top and bottom, being only presented to the outer zones of the vortex filament.

The following results were observed when a vortex filament was in this way brought over the mouth of a tube, through which up to that moment the water had been flowing with a speed of 8 feet per second.

1. The vortex was drawn into the mouth of the tube.
2. The flow in that tube was partially arrested, the discharge being reduced in a fraction of a second to about one-fifth of its previous quantity.
3. The vacuum at the core of the vortex brought over the tube mouth was momentarily intensified by the arrest of momentum of the water already in the tube.
4. A vacuous thread extended momentarily into the tube for about half the length of the glass portion, and then collapsed irregularly at various points.
5. Silvery looking fringes appeared momentarily on the entry edges of all the four tubes whether under or near the vortex.
6. It was observed that at the instant when the vortex was brought over the tubes 2 and 3 it developed a momentary bifurcation into the neighboring tubes 1 and 4; the bifurcation being of such short duration as to be difficult to see.

The apparatus was next modified for continuous working in order to ascertain if pitting of the tubes could actually be produced in this manner. (The arrangement of the apparatus is illustrated in Fig. 3.) The glass tubes were replaced by tubes of brass, continuous for the first 12 feet of their length, and then extended to 15 feet by attached 3-foot lengths of similar brass tube. A solenoid, with a make-and-break relay, was fitted to operate the lever to oscillate the inner water box, at a rate of about 15 cycles per minute and a motor-driven centrifugal pump and drain tank maintained a continuous circulation, the system being filled with brackish water from the river Tyne.

The solenoid operated lever was so adjusted by guides and stops as to bring the vortex filament alternately over the mouths of the second and third of the four central tubes, so that a comparison of these tubes afterwards with the first

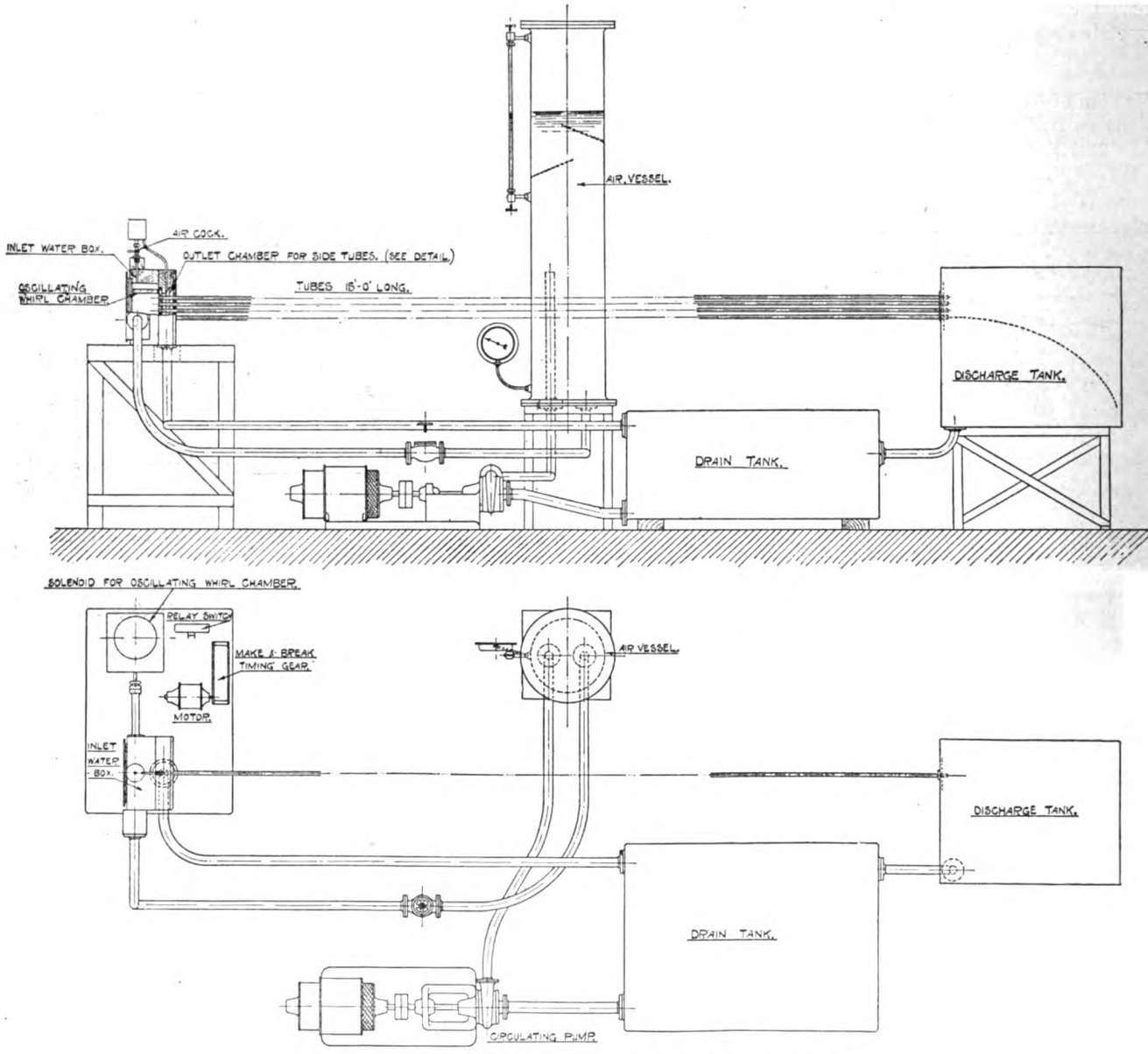

Fig. 3.—Apparatus for investigating erosion of condenser tubes

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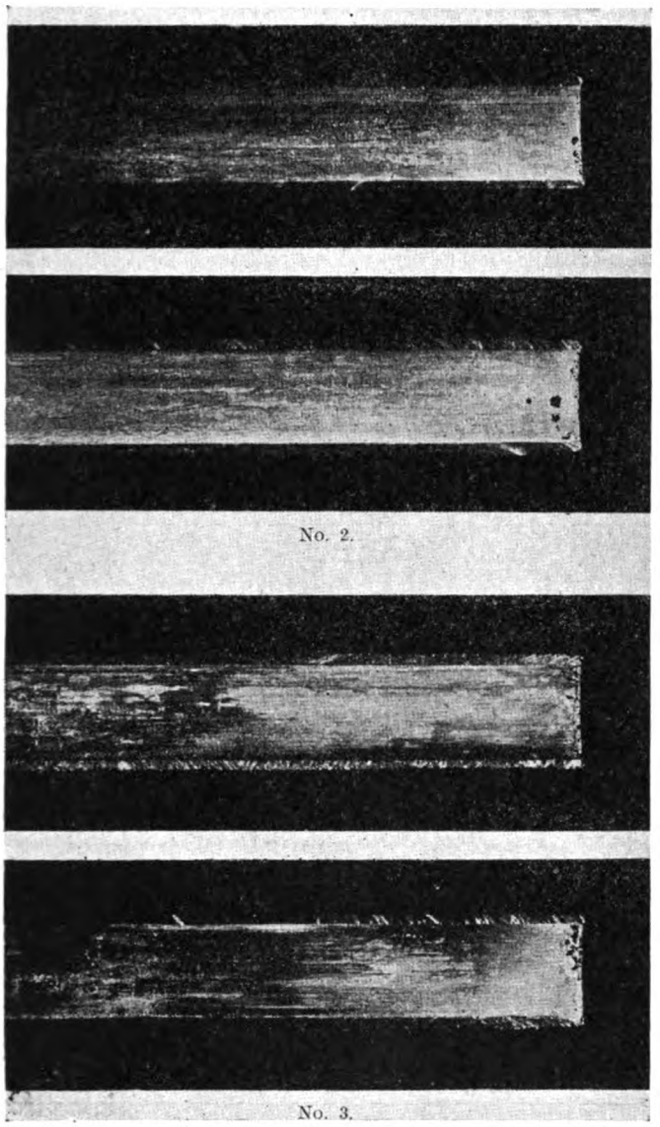

Fig. 4.—Submitted to the central part of vortex

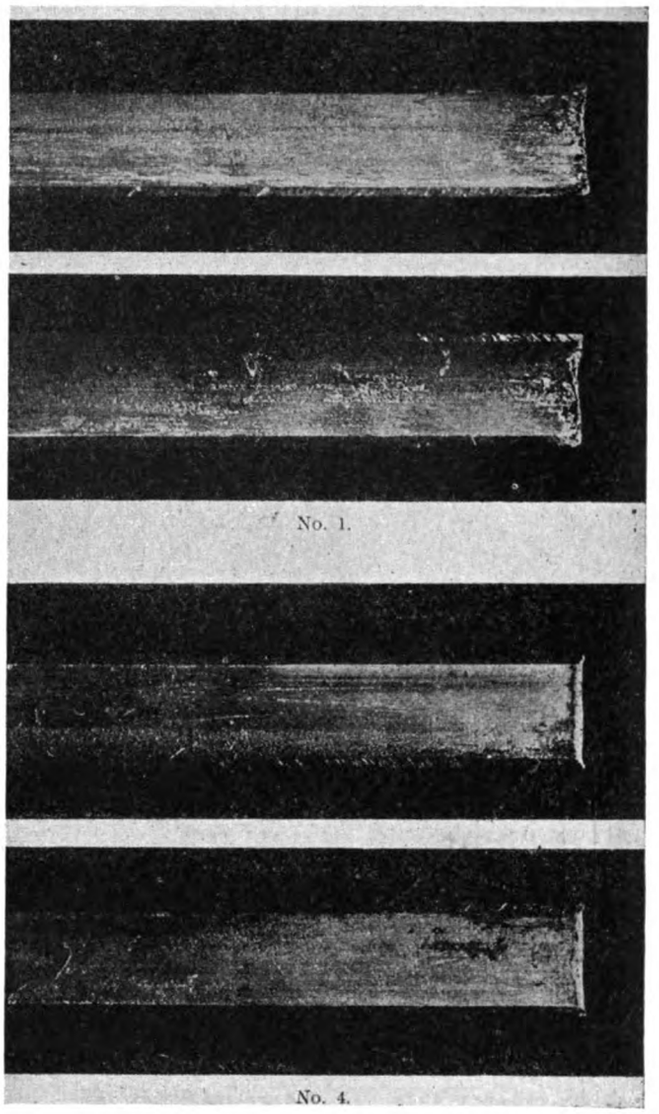

Fig. 5.—Submitted to outer zones of vortex

and fourth, which were not subjected to the action of the central part of the vortex filament, would enable any difference in effect to be definitely attributed to this action. The apparatus was run for 1,450 hours, or about two months' continuous work, after which the four tubes were taken out and the first 3 feet of each sawn in two for examination. Pitting was observed at the entry of all the four tubes, extending from about ⅛-inch to a few inches along the several tubes, beyond this the tubes were apparently unaffected. Fig. 4 and 5 are photographs of the tubes after the experiment. In one of the tubes several pits penetrated about half way through the thickness of the tube. There appeared to be very little difference in the amount of pitting in the two tubes subjected to the vortex filament, and those subjected only to the rapid transverse flow of water across their mouths.

The experiments will, however, be continued with varied conditions, including transfer of heat across the tubes to the water as in ordinary condenser practice, and it is hoped that these may throw further light upon the subject, and produce experimentally the erosion of the tubes in the central portions of their length.

In order to investigate the character of the regional disturbances occurring in a water box of usual type a further experiment was made. A model water box (Fig. 6) was constructed, about a quarter full size of an actual condenser box, with a tube plate for one hundred tubes of ⅝-inch diameter. These were bent and spread out in groups as shown in the illustration (Fig. 7), so that the discharge from each tube could be observed.

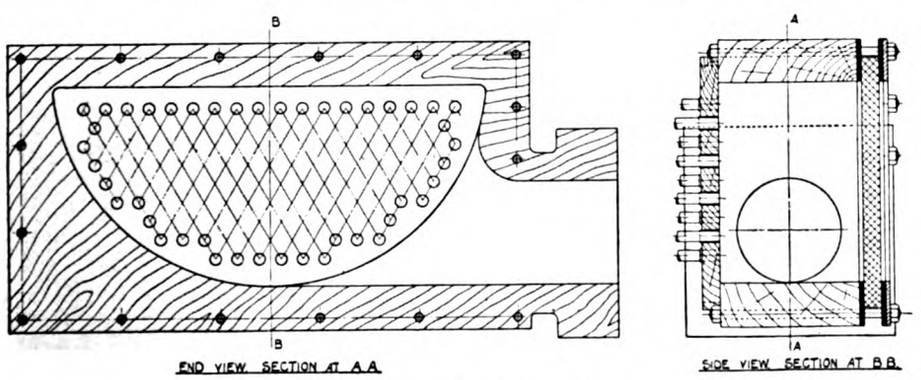

Fig. 6.—Detail of model water box

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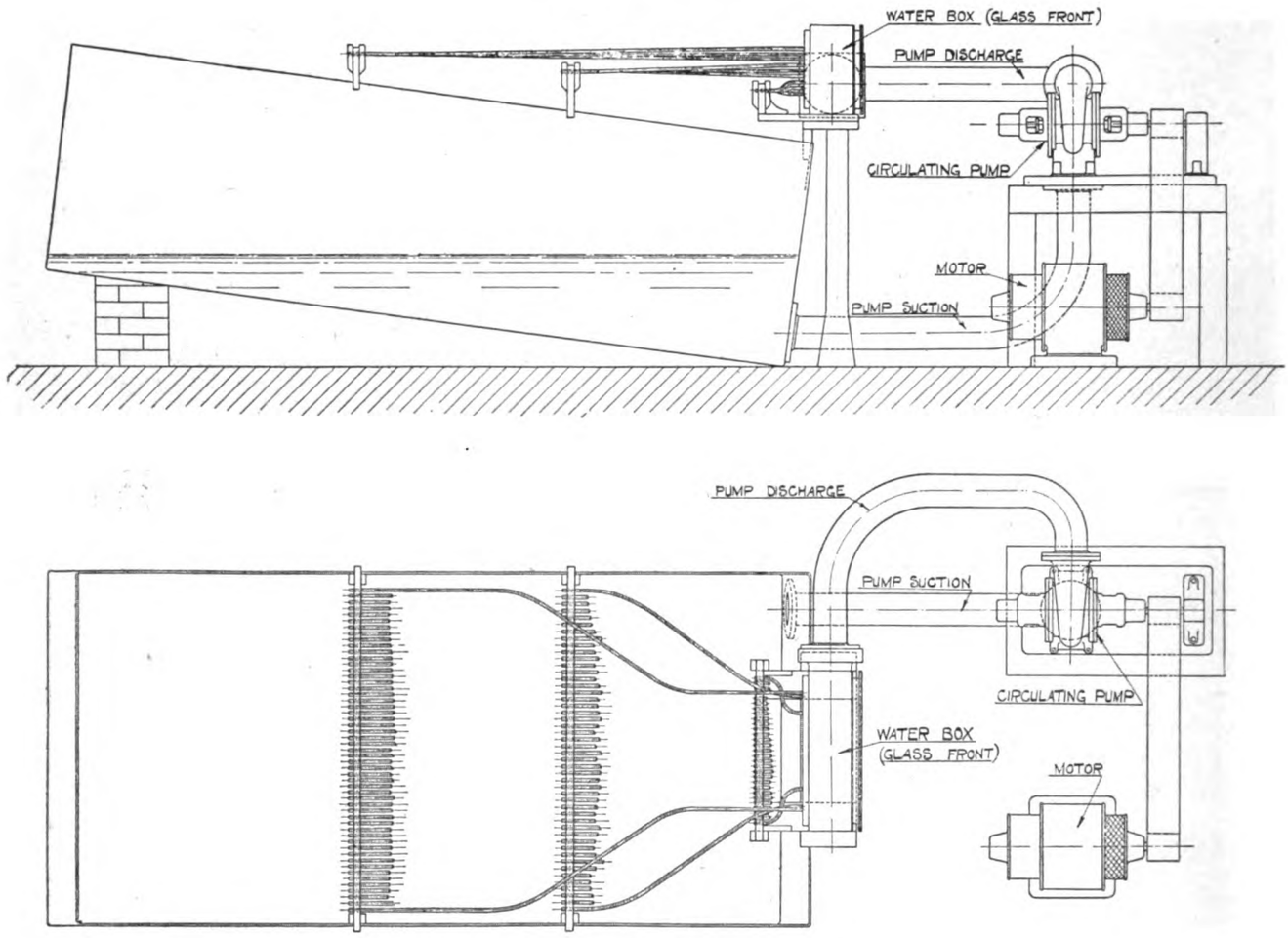

Fig. 7.—Arrangement of model water box

The water box was fitted with a glass front. Town water was used, which was circulated by a centrifugal pump. The velocity in the tubes was about the same as in an ordinary condenser, i.e., about 8 feet per second. The tubes being of different lengths retarders were fitted near their mouths to give a discharge equivalent to tubes of 15 feet length, and

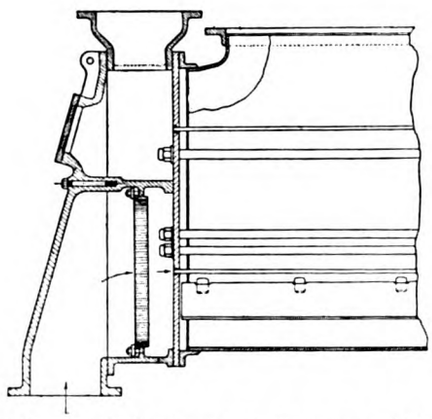

Fig. 8.—Grid in water box to annul vortex motion

to maintain the standard velocity in all the tubes. Regions of strong turbulence were distinctly observed in the water box, and the vortex centers were seen to move about from tube to tube over certain areas. The discharge from some of the tubes was found to show sudden variation; this variation corresponded, as regards the tube positions, with the vortex motion in the box, although the sudden drop of velocity was only about one-half that observed in the previous experiments with the circular water box. It, however, must be borne in mind that the vortices, in relation to the size of tubes, would only be of about one-quarter the size they would be in an average full sized condenser, and also smaller than the single vortex in the circular water box experiments.

In conclusion, it is suggested that the experiments, as far as they have been carried out, seem to lead towards the view that one of the chief causes of the erosion of condenser tubes may lie in the turbulent motion of the water in the water box of the condenser, and that this cause could be mitigated by enlarging the area of the inlet passages so as to reduce the velocity of the water as much as possible before entering the box, or entirely removed by arranging in the water box a grid of suitable mesh and with passages of depth somewhat greater than their width. Fig. 8 shows such a proposal. By the passage of the water through this grid such turbulence is practically destroyed. Grids of this kind have been tried in conjunction with the experimental apparatus of Fig. 1, and it is found that with such a grid, when the whirl chamber is moved across the tube plate exactly as before, the velocity at the discharge end of the tubes remains perfectly steady, and no vortex motion is visible in the box either behind or in front of the grid.

AMERICAN SHIPYARDS were building or under contract to build for private shipowners on May 1 221 steel vessels of 206,337 gross tons compared with 260 steel vessels at 252,377 gross tons on April 1, according to the Bureau of Navigation, Department of Commerce.

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Natural Ventilation on Board Ship

Preliminary considerations of design and factors determining the size of natural ventilators

By Wolcott Spofford

NATURAL ventilation of cargo and ship's spaces is a subject which receives little thought in this country except by the compulsion of immediate exigencies in design. The divergence of opinion as registered by the difference in the layout of natural ventilation systems in recently built ships has not been recorded and information regarding their success is scant.

While there is every reason to believe that mechanical ventilation has proven its value, even in its infancy, yet there are some spaces aboard merchant vessels which will probably be served by natural ventilation for some time to come.

The purpose of this article is to review the laws and regulations which apply to such equipment and to discuss the preliminary factors which must be considered in the design of such systems.

Natural ventilation systems, like mechanical ventilation systems, are subject to the physical laws governing the flow of fluids. They are also subject to elements which are not controllable as yet and consequently the design is governed by empirical ratios and practical considerations.

In every vessel it should be remembered that the first essentials are a watertight hull and water shedding topsides, that the integrity of the watertight subdivisions must be maintained, and that the prevention or spreading of fire is secondary only to watertightness.

The problem, then, is to supply and exhaust air to and from a given compartment in sufficient quantities without affecting the isolation or insulation of that space. Now it is evident that if a change of air is desired in a given compartment, there must be an inlet and an outlet and that two vents opening into the same compartment form an inverted syphon in which the velocity, volume and direction of flow are dependent mainly upon the relative direction and velocity of the wind, the difference in temperature between the given compartment and the open air, and the relative vertical lengths of the two vents. It is also known that the diminution of pressure at the mouth of a cowl turned away from the wind has as great an effect upon the velocity within the vent as the increase of pressure at the mouth of a cowl turned into the wind.

The idea seems prevalent that the forward vents to a compartment are exhaust vents and the after ones supply vents. This idea probably sprang from the fact that the extreme forward cowls are sometimes on the forecastle or other locations which are exposed to solid water or spray and are therefore turned aft to prevent taking water. This idea, if stated as a definite rule, is a fallacy and has no logic. As a matter of fact, it is well nigh impossible to determine whether a vent with a cowl head is a supply or exhaust ventilator, regardless of its location. The numerous and varied conditions surrounding such vents might change hourly. Perhaps the best criterion by which such vents might be designated would be the extreme vertical height of the system, but the higher the cowl above the weather deck the more liable it is to receive larger volumes of air at higher velocities and such volumes and velocities at times would overcome the head of warm air within the vent and convert these higher vents into supply vents. It can therefore be seen that, even assuming careful trimming at sea, it is most practical to design all vents with cowl heads for both supply and exhaust, so that the air can flow in either direction with as little resistance as possible.

If it is desired to produce an updraft in a specific ventilator, perhaps the most effective method in natural ventilation would be to fit a free revolving ejector head to such a vent, if the top is located in an exposed place, or a turned-down hood if located in a sheltered place.

There are five types of spaces on shipboard which present the salient problems in natural ventilation, as follows:

1. Passenger and crew accommodations.
2. General cargo spaces.
3. Machinery spaces.
4. Boiler rooms.
5. Coal bunkers.

The vent systems to each of these groups should be independent and under no condition should a vent serving one of these groups be connected to a space of another type.

Passenger and Crew Accommodations

While passenger and crew spaces on modern first class vessels are usually ventilated by mechanical systems, it may be found impracticable to ventilate certain enclosures in these accommodations by such means and a discussion of natural ventilation in these spaces will not be amiss.

In the building or reconditioning of large passenger vessels it has been found desirable to group the several classes of persons on board in order to facilitate standardization. For this reason the passengers and crew are classified as follows:

a. First class passengers and licensed officers.
b. Second class passengers and petty officers.
c. Third class passengers and crew.

In group (a) the licensed officers have the same standard of living on board ship, within reason, as the first class passengers; the petty officers have the same as second class, and the crew the same as third class. The special staff, such as purser, chief steward, doctor, etc., and their respective corps are rated according to rank. Hence, the amount of air supplied and the class of fittings and fixtures for each of these is standardized.

Ventilation is affected by several laws, rules and regulations which must be considered before the layout is made. An American passenger vessel in trade with the British Isles and carrying British subjects as passengers is affected by the laws, rules and regulations of the U. S. Steamboat Inspection Service, the British Board of Trade and the Emigration Laws of any other country at which the vessel calls or touches. The various emigration laws generally affect only the layout of the vessel and the classification rules govern the scantling and detailed construction.

Perhaps the most stringent of the various emigration laws are those of the British Board of Trade, and be it always remembered that if a vessel under any flag, in trade with the British Isles and carrying British subjects, does not comply with these regulations, the Board of Trade is empowered to prevent the vessel from clearing and the steamship company may be liable to a generous fine. Abstracts from the U. S. Steamboat Inspection Laws, the Regulations of the British Board of Trade and the Rules of the American Bureau of Shipping are cited herein. These abstracts

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shall not be construed as the full text of such laws, rules and regulations.

The British Board of Trade Regulations in general apply only to third class passengers and in brief require 5 square inches of vent area per passenger in living accommodations. This must be divided as follows:

Two vents for 75 passengers and under.
Three vents for 76 to 125 passengers, inclusive.
Four vents for 126 passengers and over.

The minimum diameter of each ventilator shall be not less than 10 inches, and the maximum diameter of each vent shall not be greater than 20 inches, and each ventilator shall not exceed 314 square inches in area, if other than round. These regulations also imply that there shall be no dampers in the ventilators to passenger accommodations.

For hospitals, the British Board of Trade requires 10 square inches of vent area per person and there shall be not less than two vents in each hospital. It has also been found that these vents, if natural ventilation only is used, shall be cowl vents.

The Board of Trade requirements for mechanical ventilation have been dealt with in a previous article published in the July, 1924, issue of MARINE ENGINEERING AND SHIPPING AGE.

The laws of the U. S. Steamboat Inspection Service governing passenger spaces are quoted in part as follows:

"That every such steamship or other vessel shall have adequate provisions for affording light and air to the passenger decks and to the compartments and spaces occupied by passengers, and with adequate means and appliances for ventilating the said compartments and spaces. To compartments having sufficient space for fifty or more such passengers at least two ventilators, each not less than 12 inches in diameter, shall be provided, one of which ventilators shall be inserted in the forward part of the compartment, and the other in the after part thereof, and shall be so constructed as to ventilate the compartment; and additional ventilators shall be provided for each compartment in the proportion of two ventilators for each additional 50 of such passengers carried or brought in the compartment. All ventilators shall be carried at least 6 feet above the uppermost deck of the vessel, and shall be of the most approved form of construction."

The two 12-inch diameter vents for 50 persons is approximately 4½ square inches per person as compared with 5 square inches required under the Board of Trade regulations. The clause stating that "All ventilators shall be carried at least 6 feet above the uppermost deck of the vessel," if taken literally, is an absurdity and is generally construed to mean that every ventilator shall be carried to 6 feet above the uppermost deck over the respective compartment.

It is also interesting to note that the U. S. Steamboat Inspection Laws state that "In any steamship the ventilating apparatus provided, or any method of ventilation adopted thereon, which has been approved by the proper emigration officers at the port or place from which said vessel was cleared, shall be deemed a compliance with the foregoing provisions." This is rather a broad statement and is quite in contrast to the emigration laws and regulations of foreign countries and their respective methods of execution.

GENERAL CARGO SPACES

The ventilation of general cargo spaces presents such variables as class and kind of commodities to be stowed therein and the climatic conditions through which the vessel might pass from clearing to destination. When such variables are met only by natural ventilation, there is no positive method of regulating the change of air or the temperature of the compartment.

The usual method of ventilating a compartment having several spaces located vertically over each other, is by the so-called telescopic vents, and while these vents have been used for more than 25 years, they are a makeshift at their best. It is of course obvious that holes through the decks of a compartment do not affect the watertight integrity of the compartment, unless the bulkheads are staggered. However, if the hatch is trunked with steel, these telescopic vents destroy the isolation and fireproof qualities of the space and in case of fire the cargo, in adjacent spaces served by the same vent, is liable to considerable damage from smoke or steam.

Whether the hatches between decks are trunked or not, it would seem almost useless to cope with fire with large ventilators open to the air unless suitable dampers are installed, for the crew could hardly be expected to fit wood tops and canvas covers to such vents when the compartment is afire, which, even if fitted, would not be fireproof. It therefore would seem that a honeycomb vent with individual dampers for each cell would satisfy the most stringent conditions and be as effective for ventilation purposes as the present telescopic vents.

The following notes on the preliminary computations will enable the designer to anticipate the approximate amount of vent area necessary as well as the amount of material for any particular job.

As has been stated above, it is almost impossible to determine the constant velocity of air within a natural vent, but it has been found in practice that for the North Atlantic trade 1 square inch of vent area to 35 cubic feet of general cargo space is sufficient. In the Levant and tropical trades this should be increased to 1 square inch to every 30 cubic feet of general cargo space.

No ventilator should be less than 12 inches in diameter, or 144 square inches, if other than round, and if run more than one deck in depth this area should be increased. With telescopic vents, each vent should have not less than 144 square inches for each opening and in the case of a very long vent this should be increased. Due allowance should be made if inside trimming gear is used. Care should be taken to avoid broad, narrow vents and openings, as a square vent is approximately 12 percent less efficient than a round vent of the same area and a rectangular vent with sides of 1:1½ is 15 percent less efficient than a round vent of the same area. No vent should be run on the dead-flat, if avoidable. Where it is found necessary to run a dead-flat, same should be 10 percent greater in area than the vertical portion of the same vent. A clear unobstructed area should be maintained throughout each vent and the effective area should be constant as far as is practicable. Wherever a vent changes shape, a triangulated transition piece of proper depth should be fitted to maintain the effective area.

The number of vents to a compartment is largely determined by the size of the compartment and the necessary vent area. Where 4 vents are installed they should be located one in each outboard corner of the compartment. Where 2 vents are installed they should be located one at each end of the compartment. It has been found desirable to install such vents in multiples of 2 as it allows a more even distribution of air throughout the compartment.

As a fire preventative, no vents whatsoever should open in the light and air trunks or in the engine or boiler casings as it has been found from experience that fire emitted from such vents will follow the paint on the steel bulkheads and pass through the windows or other openings in passageways to passenger and crew quarters, unless such windows and openings are fitted with fireproof glass and metal sashes and frames.

All vents in way of cargo spaces should be built of not less than 10-pound steel plate. Vents below the designated bulkhead deck should be made watertight and any vent passing through a watertight bulkhead must be made watertight up to the designated bulkhead deck. While the Navy allows welding in such cases except in special instances,

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the American Bureau must be considered where welding is desired below the bulkhead deck and each instance of welding must be approved by the Bureau before such work is begun. British Lloyds reserves the same rights as the American Bureau in this connection. It is believed, however, that welding is particularly adaptable to ventilation work as strength is not always as necessary as tightness, and should welding develop cracks it would merely impair

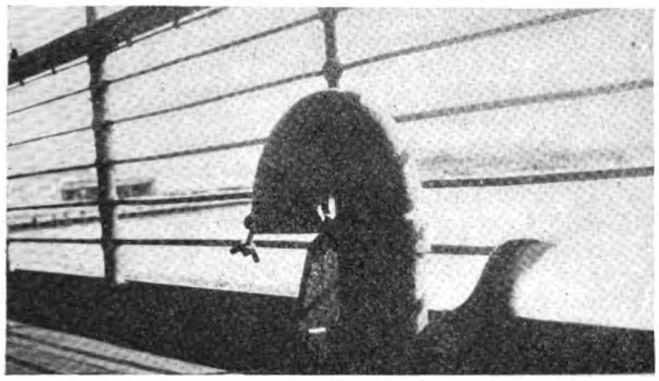

Fig. 1.—Cast iron gooseneck ventilator to coal bunker

the tightness of the vent and this could be calked and made good; whereas, such is not the case where strength is of prime importance.

The American Bureau of Shipping Rules are very brief on the subject of ventilation and are quoted in part as follows:

"(1) Hold ventilators on the weather portions of freeboard decks and on forecastle decks are to have coamings 36 inches high; those on the weather portions of bridge houses and poops may be 30 inches high. The thickness of the coamings is not to be less than 0.30 inch in vessels not exceeding 100 feet length, and 0.40 inch in vessels 200 feet length and above; the thickness for vessels of intermediate lengths may be obtained by interpolation. The coaming angles are to be 0.10 inch thicker than the plates and secured to deck plating of sufficient thickness and properly stiffened, by rivets spaced not more than 4 diameters center to center. If coamings are more than 36 inches high and are not supported by adjacent structures, they are to have additional strength and riveting. Ventilator cowls are to fit closely over the coamings and are to have at least 15 inches of housing. Ventilator coamings are to be provided with strong plugs and canvas covers or efficient metal covers which can be rapidly and effectively secured in place."

While the American Bureau rules state that the coamings are to have at least 15 inches of housing, it has been found desirable to allow one diameter of the vent coaming for housing, or grip, of vents over 15 inches in diameter and a 15-inch housing for vents under 15 inches in diameter.

MACHINERY SPACES

The ventilation of engine rooms is purely a matter of judgment of the designer. However, the usual practice is to have a dummy stack or hinged lights over the engine casing for exhaust, and cowl vents which supply air to the lower elevations of such spaces. It has been found desirable in practice to install small blowers to exhaust the air from the wings under the flats and release such air near the top of the engine casing or into the open air.

In checking several vessels it has been found that 1 square inch, of vent area to 25 cubic feet, of engine room, including the engine casing, is sufficient for turbine and Diesel engine rooms and 1 square inch, to 30 cubic feet, for reciprocating engine rooms.

As it is extremely necessary to keep the temperature in refrigerated spaces under constant control, such spaces are almost entirely ventilated by mechanical means and therefore will not be dealt with in this article.

BOILER ROOMS

The supply of air by mechanical means for the combustion of fuel in boilers has become common practice. However, the marine designer usually allows for every probable contingency and for this and other obvious reasons natural ventilators are installed in boiler rooms. Broad assumptions have been used for the purpose of arriving at the proper size vents for such spaces, but, in checking the final results with several well known successful vessels, they are remarkably close.

The fuels used for this approximation were commercial grades of bituminous coal and oil. By means of the combustion formula and an analysis of the products of combustion it was found that the area of the boiler room vents will be proportional to the area of the stack and that for coal the ratio of vent area to stack area is as 1:4, and for oil as 1:3. This ratio is based upon the primary assumptions that all of the air required for combustion is delivered through the boiler room vents and that the velocity of the air in these vents is equal to the velocity of the gases in the stack. The ratios given will vary slightly according to the chemical analysis of the fuel and this will be taken care of by the combustion formula. However, the ratios given may be taken as a minimum.

Since the building of the *Mauretania*, it has been the tendency to eliminate the large cowl vents as far as is practicable and the growing trend toward the more economical

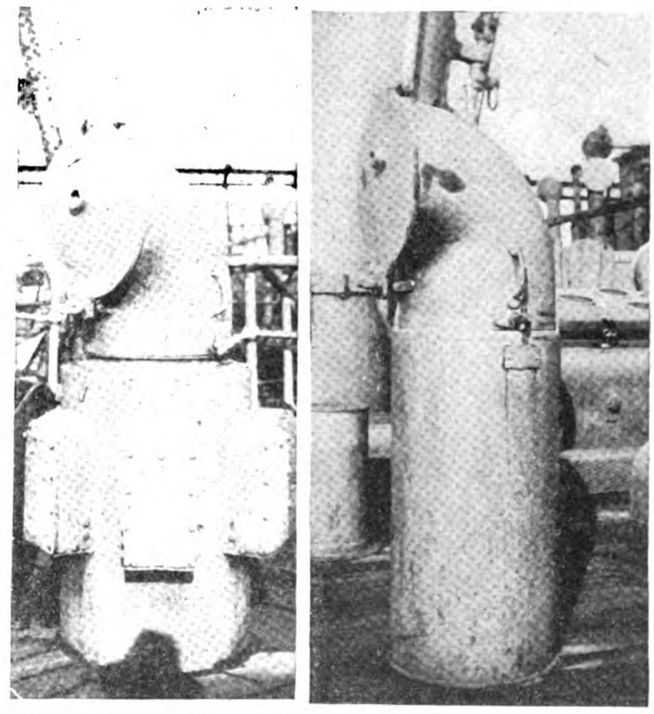

Fig. 2 and 3.—Ventilators with cast iron cowls on large German vessel

regulation of fuel consumption has caused the consequent use of mechanical draft. As an auxiliary for ventilation, the fidley tops are usually left open and covered with gratings. While this practice is perhaps unavoidable in coal fired ships because of the intense heat in the boiler rooms, it would nevertheless prove a poor auxiliary should the blowers be temporarily interrupted, as the heat generated over the boilers tends to escape through the open fidley tops and the necessary and consequent increase in the velocity of inflowing air through undersized vents to the boiler room would seriously hamper the rate of combustion in the boilers and would probably tend to cause "flare backs."

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If for any reason, when steaming, the draft blowers should be temporarily out of commission, it would be safer to close the fidley tops, if possible, and allow the boilers to draw the air for combustion from the boiler room vents and the engine room, assuming that the boiler room vents are of sufficient size and are built to supply air near the boiler room floor. This will not increase the temperature in oil burning firerooms to an unbearable point.

COAL BUNKERS

The ventilation of coal bunkers has caused considerable discussion and there are still differences of opinion as to whether such spaces should be ventilated or not. The principal questions involved are: Deterioration of coal and spontaneous combustion due to contact with air; the isolation of bunkers, if same should be afire; and admissibility of water through the vents to the bunkers in heavy weather. While these questions have debatable points of merit, it is nevertheless the fact that coal gives off considerable gas in stowage and it is highly desirable to allow this gas to escape to the open air, particularly when scaling and painting bunkers and when coaling, otherwise this gas may be driven into the boiler rooms. It is interesting to note that the British Board of Trade compels British vessels to ventilate coal bunkers whereas in this country the trend is against it.

Fig. 1 is a photograph of a ventilator to coal bunkers on a large German built vessel, the operation of which offsets many of the arguments against the ventilation of such spaces. These gooseneck vents are made of cast iron and are fitted with cast iron flapper covers with dogs and rubber gaskets such that they may be closed and made tight when desirable.

CONCLUSION

In conclusion, it can easily be seen that the construction of natural ventilators is as varied as the conditions under which they are imposed and, in consequence, it is seldom that any two ventilators present the same problems in detailed construction. The space to be ventilated, the longitudinal and athwartship location, the number of decks through which it passes and the allocation of the spaces on such decks, all combine to determine the material and transformations of shape. While it is impossible in a limited space to cite all of the probable conditions incident to different types of vessels, the factors given above should serve as a guide in the preliminary considerations of design, and the layout of the proposed vessel will govern most of the details of construction not otherwise covered.

Lincoln Arc Welding Prizes

THE American Society of Mechanical Engineers has accepted the custody of $17,500 given by the Lincoln Electric Company of Cleveland, Ohio, U. S. A., to be awarded, under the rules of the competition, to those contributing the best three papers disclosing new information that will tend to advance the art of arc welding.

The purpose of this competition is to encourage improvements in the art of arc welding, the pointing out of new and wider applications of the process, or indicating advantages and economies to be gained by its use, as these latter will be the chief bases upon which the winning papers will be selected. Prizes will be awarded as follows: First prize, $10,000; second prize, $5,000; third prize, $2,500.

RULES OF THE COMPETION

1. *Anyone, in any country of the world, may compete for these prizes.*

2. All papers must be written in duplicate, in the English language, and submitted to the Council of The American Society of Mechanical Engineers, addressed to the Secretary, Calvin W. Rice, 29 West 39th Street, New York, N. Y. All exhibits shall also be in duplicate, and captions, titles, legends and notes shall also be in the English language. All papers must bear evidence of having been sent before January 1, 1928 in order to be considered in this competition. Any paper arriving after January 31, 1928, will be disqualified,

3. Every paper should include all necessary drawings, photographs, or other exhibits, in order that the disclosure may completely present the suggestions of the competitor.

(*a*) The utility of the suggestions must be shown not only for the application but also for possible use in connection with other designs and for their purposes.

(*b*) The possible advantages and economies of the methods suggested should be made clear, as these will be the chief bases upon which the winning paper will be selected.

4. The practicability of the suggestions must be evident from the paper. It is not necessary, however, that its actual application be fully shown, if possible uses are made clear.

5. Originality of design is preferable, either in the method of applying the weld or in the design of the welding parts for their arrangement. Designs which are of no practical use will only be considered in case they include suggestions which could self-evidently be applied in other ways than those suggested. Methods of applying the arc or the welding art which will improve existing machines, or make commercially possible machines which, in the light of previous engineering, have been regarded as impractical, are specially desired.

6. It is not necessary that all parts of the structure should be made of welded metal. It is only necessary that one or more parts be so made.

7. In case two or more identical suggestions are received, the one bearing the lowest serial number assigned to the paper on its receipt by the Secretary of The American Society of Mechanical Engineers will have precedence. Because of this rule, competitors are urged to submit their papers as soon as they are prepared.

8. The Council of The American Society of Mechanical Engineers may withhold any or all awards.

9. Each paper must be typewritten on one side of 8½" x 11" paper and bound at the top with a protecting cover or jacket. The name and address of the competitor must appear on the front cover. Both copies of each paper must be enclosed within a sealed envelope, on the outside of which will be placed the name and address of the competitor and the following legend: "Submitted to The American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y., in competition for the Lincoln Arc Welding Prize." This sealed envelope must be enclosed within a mailing wrapper. The receipt of each paper will be acknowledged.

10. The Committee of Judges will not pass upon the acceptability of any apparatus suggested as a proper subject for this competition.

11. In submitting papers, each competitor gives to The American Society of Mechanical Engineers the right to publish his paper, should the Society desire to do so in any of its several publications. No papers will be returned to any competitor.

12. The decision of the Committee of Judges in interpreting the foregoing Rules will be final.

It is the purpose of The American Society of Mechanical Engineers to present these awards at the stated 1928 Spring Meeting of the Society. All competitors will be properly notified of the action of the Judges.

All communications should be addressed to The American Society of Mechanical Engineers, Calvin W. Rice, secretary, 29 West 39th Street, New York City, U. S. A.

LAID-UP SHIPPING IN BRITISH PORTS totaled only 360,000 gross tons on April 1, as compared with 547,000 tons on January 1 and 540,000 tons on April 1, 1926.

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Longshoremen and Harbor Workers' Compensation Act

By Albert S. Regula*

THE Longshoremen and Harbor Workers' Compensation Act, passed by Congress, March 4, 1927, becomes effective on July 1, 1927. By its terms 300,000 longshoremen and harbor workers are brought under the protection of workmen's compensation. These men are engaged in the extra-hazardous work of loading, unloading and repairing vessels (excepting vessels of less than 18 tons net) not only in the seaports but elsewhere on all navigable waters of the United States. Under this provision the employees, other than seamen, of railroads and manufacturing concerns as well as those of purely shipping interests are covered during such operations as are carried out on board vessels afloat. This class of workers had been without compensation protection since 1917. The act thus has a wider application than has been commonly understood, for navigable waters are defined as waters which form a continued highway for interstate or international commerce. Within New York where more harbor workers are affected than in any other state, they include the Hudson, Saint Lawrence, and Niagara Rivers, Lakes Erie and Ontario, and the streams and lakes within the state that are commercially tributary to them, including the canals.

The enactment of this legislation and the various earlier attempts to remedy the situation constitute one of the most interesting phases in the development of compensation legislation in this country. When the first state workmen's compensation laws were passed in 1911, harbor workers were included as a matter of course. While the status of maritime employees under these laws was questioned, the state courts held that workmen's compensation was a valid substitute for the remedy under admiralty or maritime law. In 1914, a longshoreman named Jensen was killed while engaged in unloading a vessel in New York. Compensation was awarded for death by the State Industrial Commission and the state courts upheld the award. However, in 1917, the United States Supreme Court held, by a 5 to 4 decision (Southern Pacific Company vs. Jensen) that when injured on board a vessel the accident was maritime and therefore outside of state jurisdiction, and that the federal remedy in admiralty entirely excluded state compensation benefits.

Two attempts were made by Congress, in 1917 and 1922, to remedy this situation so as to confer the benefits of the local state compensation acts on harbor workers in case of injury on board a vessel. These acts attempted to amend the United States Judicial Code, which up to that time had granted to courts of the United States jurisdiction over all admiralty and maritime civil cases by a provision of the Judicial Code "saving to suitors in all cases the right of a common law remedy where the common law is competent to give it." The first of these, effective April 17, 1918, proposed to add to the above the words "and to claimants for compensation for injuries, their rights and remedies under the workmen's compensation law of any state." Under this amendment maritime employees had the right to elect compensation in lieu of common law or admiralty remedies. However, on May 17, 1920, the Supreme Court by another 5 to 4 decision (Knickerbocker Ice Company vs. Stewart) held this amendment to be unconstitutional on the ground that the power delegated to the states would interfere with the proper harmony and uniformity of maritime law.

The second attempt, in 1922, undertook to distinguish between maritime workers such as seamen and those who had mixed duties, such as longshoremen, by placing all maritime workers except masters and seamen aboard vessels, under the jurisdiction of the various state workmen's compensation laws. This law was declared unconstitutional by the Supreme Court on March 6, 1924, the court holding that the principles laid down in the Knickerbocker vs. Stewart case were applicable, despite the attempt to differentiate between local and seafaring workers (State of Washington vs. Dawson & Company). There was but one dissenting vote.

On October 18, 1926, some measure of relief was afforded these workers when the Supreme Court construed the Jones Act of 1920 as including within its scope longshoremen who are engaged in a maritime service formerly rendered by the ship's crew. Under the Jones Act seamen had been given the same rights and remedies as railway employees in interstate commerce under the Federal Employers' Liability Act. This decision, however, did not apply to mechanics, carpenters and other ship repairmen, whose position remained unchanged.

These several decisions of the Supreme Court left the maritime workers in a rather peculiar position as respects compensation. A longshoreman or other harbor worker, if injured on the dock, received the benefits of the state compensation law, but once he crossed the gang plank to engage in work on board the vessel, his only remedy in the event of injury was to sue under the admiralty law or under the common law where that law was competent to give a remedy. After the several unsuccessful attempts to afford relief through the amendment of the Judicial Code, as above cited, it became apparent that the only possible solution was in the enactment of a federal compensation law for harbor workers which would in no way interfere with the uniformity of maritime law. All efforts were accordingly concentrated on this principle with the result that the Longshoremen's Compensation Act was passed on March 4, 1927.

Summary of the Terms of the Act

Groups Covered: The act applies to harbor workers including longshoremen engaged in loading or unloading vessels and to mechanics, carpenters and other ship repair men working on board vessels afloat. The master or members of the crew or any person engaged by the master to load or unload, or to repair any small vessel under 18 tons net are specifically excluded. Compensation is payable if "disability or death results from an injury occurring upon the navigable waters of the United States (including any drydock), and if recovery. . . may not validly be provided by state law," unless occasioned by the intoxication of the employee or willful intention of the employee to injure or kill himself or another. The term injury is defined to include occupational diseases or infection arising naturally out of the employment.

The act is compulsory in its application to employers and employees within its scope, the liability of the employer being exclusive and in place of all other liability. Neither the injured employee nor his legal representative, next of kin or anyone otherwise entitled to recover damages is permitted to proceed in an action for damages at law or in admiralty on account of injury or death unless the employer has failed to secure payment of compensation as required by the act.

*With Industrial Relations Counselors, Inc., 165 Broadway, New York.

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In such case the employer may not set up the common law defenses of assumption of risk, fellow-servant's fault or contributory negligence. Every employer must secure the payment of the prescribed benefits by any of the common authorized methods, such as stock or mutual insurance, or as a self-insurer to pay compensation directly. In the latter case, the employer must furnish satisfactory proof of financial ability with security if required by the administrating commission.

Administration: The act is to be administered primarily by the United States Employees' Compensation Commission. For this purpose the commission is authorized to formulate rules and regulations, establish compensation districts, direct vocational rehabilitation of permanently disabled employees, appoint and fix the compensation of technical assistants and medical officers, and appoint and fix the compensation of deputy commissioner or other officers and employees. The commission is authorized to appoint any member of a state board, commission or agency to act as deputy commissioner and to make arrangements for the use of personnel and facilities of state boards in the administration of the act.

The direct administration of the act is through deputy commissioners to be appointed by the commission for each compensation district. The deputy commissioners have full power and authority to make investigations of accidents, conduct hearings, reject claims or make awards, and determine all questions in respect to claims. The deputy commissioners are not bound by common law or statutory rules of evidence or by technical or formal rules of procedure in making investigations or conducting hearings but may proceed in such manner as to best ascertain the rights of all parties. The conclusions and decisions of deputy commissioners are subject to review through injunction proceedings instituted in the Federal District Court having jurisdiction.

Compensation for Disability: The basis of compensation is two-thirds of wages, payable after a waiting period of 7 days following the injury, the waiting period being compensated for if the disability exceeds 49 days. The maximum weekly benefit is $25 and the minimum $8, or actual wages if less than the minimum. The total compensation payable for injury or death may not exceed $7,500. The employer must furnish such medical, surgical or other attendance or treatment as the nature of the injury may require.

Total disabilities (permanent or temporary) are compensable during the continuance of disability. Temporary, partial disabilities are compensated for on the basis of two-thirds of the loss in earning power. In the case of permanent, partial disabilities, compensation is payable according to a specific schedule ranging from 15 weeks' compensation for the loss of the fourth finger to 312 weeks for the loss of an arm. If temporary total disability and permanent partial disability result from the same injury, there is provision for extension of the benefits for the permanent disability, if healing requires a longer period than is fixed in the act for the specific injury. An award for permanent partial disability survives in case of employee's death from other causes and is payable to the widow or surviving children.

In addition to the compensation noted above, an employee undergoing vocational rehabilitation may receive additional compensation for his maintenance not to exceed $10 a week, out of a special fund created for this purpose. In case of permanent partial disability followed by a second injury which, combined with the first, causes permanent total disability, the employee receives the same compensation as for a permanent total disability. However, the employer is liable for compensation only for the disability caused by the second injury, the balance being paid out of a special fund provided for such cases.

Compensation for Death: The statute provides for death benefits of 35 percent of average weekly wages to the widow (two years' benefit to widows upon remarriage) and an additional 10 percent for each surviving child under 18 years of age. Upon the death or remarriage of the widow, or if there is no widow, benefits of 15 percent go to each surviving child. The statute also provides for benefits of 15 percent each to dependent grandchildren, brothers and sisters under 18 year of age, and 25 percent each to parents and grandparents, subject however, to the preference of the widow and children for their full benefits. The total amount of death benefits payable in any case cannot exceed two-thirds of weekly wages, nor can the total benefits exceed $7,500.

The average weekly wages in computing death benefits are considered to have been not more than $37.50 nor less than $12. The total weekly compensation, however, cannot exceed the weekly wages.

In addition the act provides for funeral expenses not to exceed $200.

Claim Procedure: Written notice of injury or death must be given to the deputy commissioner and the employer within thirty days. However, failure to give such notice does not bar a claim if excused by the deputy commissioner for reasons specified.

A claim for compensation may be filed with the deputy commissioner at any time after the first 7 days of disability or after death, and such claim must be filed within one year. Interested parties are notified by the deputy commissioner within 10 days that a claim has been filed and are given 10 days within which to request a hearing if liability is questioned. The deputy commissioner makes an award or rejects the claim within 20 days after a hearing or within 20 days after notice of claim has been filed if no hearing has been requested. The compensation order becomes effective on filing and final within 30 days, unless an appeal is taken to the Federal District Court having jurisdiction on the ground that it was not in accordance with law.

Compensation is payable by the employer or carrier without an award unless the liability is controverted and a hearing requested as above noted. The first payment is due on the 14th day after the employer has knowledge of the injury or death, and semi-monthly thereafter. Various penalties are provided for if the compensation is not paid as due.

Special Fund: Provision is made for a special fund to be established in the treasury of the United States out of which payments are made upon order of the commission for the maintenance of employees undergoing vocational rehabilitation or for second injury cases causing permanent total disability. The fund is accumulated through payments by the employer of $1,000 as compensation for death from injury of each employee without dependents. This amount is divided equally as between the rehabilitation fund and the second injury case fund. All amounts collected as fines and penalties under the act are also paid into this fund.

Accident Prevention: The commission is authorized to make studies and investigations as to safety provisions and causes of injuries, and may make recommendations to Congress and to employers and carriers as to the best means of preventing injuries. For this purpose access to docks, wharfs, vessels and other places of employment is to be permitted in order that safety inspections of structures, tools, appliances and machinery may be made.

PROBLEMS OF ADMINISTRATION

The above summary is intended to direct attention to important sections of the act relating to coverage and administration provisions. There are in addition, standard provisions with respect to insurance, third party liability, liability of contractors for subcontractors, etc., which are

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usually found embodied in the best of existing state compensation acts.

While the act becomes effective July 1, 1927, no appropriation was made by Congress for its administration. Since the act provides that no stevedoring firm can be employed to load or unload a vessel without a certificate from the district deputy commissioner indicating compliance with the provisions of the act, it is evident that a serious situation confronts the United States Employees' Compensation Commission in taking steps to meet the administrative requirements of the act. It is quite probable that funds may be diverted or assistance be forthcoming from some other source to permit the necessary preliminary work to be instituted. In any event, the number of deputy commissioners appointed and the designation of compensation districts will undoubtedly be materially curtailed and the efficient administration of the act seriously handicapped. Thus, while it was originally expected that the act would be administered from twelve compensation districts it has been necessary to reduce the number to five. These districts will be operated through offices in New York, Baltimore, New Orleans, Cleveland and San Francisco. Such important seaports or lakeports as Boston, Philadelphia, Norfolk, Los Angeles, Seattle, Portland, Chicago and Buffalo will, for the time at least, be covered by the deputy commissioners in the five districts named.

One of the principal difficulties arising out of the act will be one of jurisdiction. Already, marked confusion exists because of the many court decisions on the question of admiralty jurisdiction which has been held to embrace not only those cases which depend on locality for jurisdiction but also those which depend on the nature of the contract, a maritime contract being enforceable in admiralty. Thus, the New York Court of Appeals has found itself squarely reversed in decisions in which it declared its full purpose of following the principles laid down by the Supreme Court of the United States. The act covers injuries occurring on the navigable waters of the United States, if recovery through workmen's compensation proceedings may not validly be provided by state law. In other words, jurisdiction is not clearly defined, and it is quite likely that employers will attempt to keep jurisdiction under the state law because of the less liberal provisions in most states, while employees will attempt to place jurisdiction under the new federal act. This difference of benefits as between the state and federal acts is quite marked, both as to percentage of wages payable as compensation during disability and the maximum and minimum benefits for temporary and permanent disabilities, and death benefit. For example, the maximum weekly benefits under the federal law is $25 a week, whereas the maximum in New Jersey is $17, Georgia $15, Pennsylvania $15, Texas $20, and California about $20. The maximum compensation for death benefits ranges from about $3,500 in several of the States and practically unlimited liability in New York to a maximum of $7,500 under the federal law.

It is expected, of course, that in the majority of cases the place of injury will not be difficult to define, as between those occurring on board a vessel and those occurring on land.

Another interesting situation created by the act is that it extends workmen's compensation to the five states in the south—North Carolina, South Carolina, Florida, Arkansas and Mississippi—that are now without state compensation laws. This creates in these states a rather anomalous situation in that longshoremen and harbor workers will be protected by federal compensation for injury occurring upon navigable waters but will be without protection for injury on land. However, it is quite probable that the act will serve to stimulate legislative action in these states.

While the act authorizes the commission to deputize members of state boards or commissions, it is questionable whether such action would be desirable by reason of the confusion which may arise in the attempted administration of a state act and a federal act that differ materially in their provisions as to benefits and procedure.

The provision for direct payment of compensation by employer to employee, safeguarded by the procedure of reporting all settlements to the deputy commissioner as provided for under the act, should materially expedite the payment of compensation to the injured employee. Awards by the deputy commissioner are made only in case a hearing has been requested. Varying interpretations of the law may result since no provision has been made for review of awards by the commission, but this may be obviated to some degree at least by the fact that the commission has been authorized to prepare rules and regulations governing procedure. In any event, direct appeal to the federal court having jurisdiction is provided for.

The passage of this act, extending workmen's compensation to longshoremen and harbor workers, leaves only seamen, railroad employees of inter-state carriers, and private employees in the District of Columbia, and private employees other than longshoremen and harbor workers in the states of North Carolina, South Carolina, Florida, Arkansas and Mississippi without the protection of workmen's compensation legislation.

Inconsistency in Ship Performance

By J. Lockwood Taylor

MOST writers on the subject of ship performance analysis have referred to the frequent inconsistency of the results obtained, with the methods usually employed, for different vessels and even for sister ships. The effect of fouling of the bottom is well recognized, but the importance of wind, even when hot directly opposing the motion of the ship is not so frequently realized. As however, a side wind of speed comparable to that of the ship, appears to be on the bow, at an angle of about 45 degrees, in whichever direction the ship is traveling, and as the pressure on the superstructure due to this relative velocity is, so far as is known from experiment, comparable to that experienced with the wind directly ahead, it is evident that under these conditions the ship has in effect a moderately strong wind against it on both runs so that a wind blowing *across* the measured mile may actually have more effect on the mean speed than a similar wind blowing parallel to the course.

That such influences as wind and fouling are actually responsible for a good proportion of the discrepancies which occur may also be inferred from the fact that in the vessels' subsequent service these do not always remain apparent, although no doubt isolated instances may be cited in which due to some combination of unfavorable circumstances over a long period one ship has attained an appreciably less speed than sister ships.

Turning now to the wider problem of unexpectedly bad performances of vessels not precisely similar to those previously built, results which can in some instances, though not in all, be remedied by a change of propeller, it is probably correct to say that in the majority of these cases the principal error has been in the prediction of wake, and it is the reason for this which is to be sought. No doubt it is the case that the usual approximate formulæ for wake are not intended to be regarded as anything more than a rough guide, and the precise influence of proportions and shape of sections, to mention only two of the factors likely to influence wake, has never been made clear.

On considering the whole question of wake, however, one is struck by the fact that that portion (negative or positive)

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of the whole wake velocity described as "wave wake," from its association with the series of waves due to the motion of the vessel, has received very little attention, either from the theoretical or experimental side. Even if it were true to say that the wave crest maintained a definite position in relation to the stern at all speeds, it would still be necessary to make allowance for the fact that the height of wave (to which the orbit velocity, i.e., wave wake is proportional at a particular speed and length of wave) increases with speed of ship in a more or less arbitrary manner, so that it can hardly be correct to assume, as is commonly done, that the wake fraction is the same at all speeds. And as it is also known, both from inspection of model wave profiles and from the theory of the subject, that the wave crests move along the hull continuously with increase of speed, so that a crest at the stern will alternate with a hollow, at speed intervals comparable to the ordinary resistance hump and hollow speed intervals, it is obvious that the wave portion of the wake will be alternately positive and negative at such speeds.

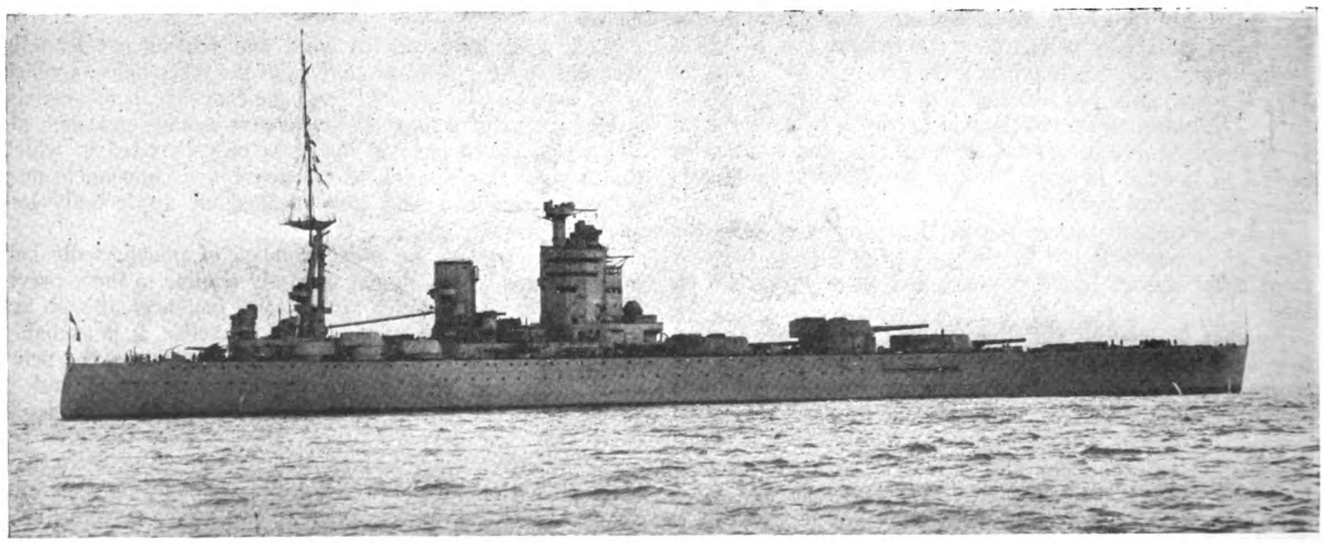
As regards the actual amount of fluctuation, Mr. W. C. S. Wigley has observed (Trans. I. N. A., 1926) a wave height of 1 inch at the stern of a model, corresponding to 2 feet for a 400-foot ship, at a speed corresponding to 14 knots for the full-sized ship. It can be easily calculated (and was in fact pointed out in the discussion of the paper) that the corresponding particle velocity at the surface is 1.6 knots, or 0.12 of the ship speed, while the velocity at a depth of 12 feet, near the center of the screw, is about one-half of this amount. Thus taking the mean value over the disk, about 24 percent of the whole wake velocity of about 0.27 of the ship speed is liable to change sign as the speed increases, and whatever the effect on the overall propulsive efficiency of the screw's working in crest or hollow, as the case may be, it must at least be designed for the wake and consequent speed of advance appropriate to whichever condition applies. From the point of view of the classical analysis, the "screw in wave crest" condition is apparently to be preferred, as giving the greatest wake gain, provided this is not associated with too great slip, nor with a low hull efficiency due to increased resistance augment, but as this is not unlikely to be the case, it may be safest to ignore the hypothetical advantage of wake gain, and look rather at the effect of wave wake on the wake *distribution*, principally in the vertical direction.

It is known that the wake velocity varies very considerably, especially behind a full form, from top to bottom of the screw disk and the wave portion of the wake will also vary, as already indicated, particularly at slow speeds, when the whole disturbance due to the ship's passage extends only to a moderate depth. The important point is that while the effect of a wave crest in way of the screw is to *increase* the disparity, the effect of a hollow will be to even up the forward water velocity from waterline to keel, and so greatly improve the working conditions of the propeller, at the same time lessening the tendency to torsional vibration, both of the shafting and of the hull itself, which is due to the extra work thrown momentarily on the uppermost propeller blade.

Unfortunately at present it is hardly possible to say what are the conditions to be fulfilled in order that the screw shall be working in the trough of the wave, but here the various tank authorities may be able to help us with the results of their experience, as probably more observations of wave profiles have been made than have actually been published. In the meantime observation of actual conditions during trial trips may be of guidance to the designer, although a word of caution may be advisable as to the possible masking effect of the suction of the propeller itself on the level of the water in its immediate vicinity, since it is the level at the stern of the towed vessel with which we are really concerned, as determining the conditions which the propeller has to overcome.

British Battleship Nelson

IN accordance with the terms of the Washington Naval Disarmament Treaty Great Britain began the construction of two new battleships late in 1922. The first of these, the *Nelson*, was built by Sir W. G. Armstrong, Whitworth & Company, Ltd., Newcastle-on-Tyne. Her machinery was constructed by the Wallsend Slipway & Engineering Company, Ltd., Wallsend-on-Tyne. The *Nelson* is 702 feet long on the waterline; 106 feet extreme beam and at a draft of 30 feet has a displacement of 35,000 tons. The main armament consists of nine 16-inch guns mounted in triple turrets. The secondary armament consists of twelve 6-inch guns mounted in twin turrets grouped three on each side at the after end of the ship. The trials of this vessel were held in April of this year. The sister ship *Rodney* is being completed by Cammell Laird and Company, Ltd., at Birkenhead.



(Photograph from Frank & Sons, South Shields, England)

H. M. S. Nelson, built by Sir W. G. Armstrong, Whitworth and Company, Ltd., leaving the Tyne for trials on April 22

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Ship Safety Work on the Great Lakes*

Inventive genius developed by officers and crews on the bulk freighters—Results of ship safety committee work

By George A. Marr†

AT the meetings of the Marine Section of the National Safety Council in preceding years I endeavored to point out the working method of the ship safety committee as introduced on the Great Lakes by the Lake Carriers' Association, the extent to which severe personal injuries have been reduced, the extent to which fatal injuries have been curtailed and to show in particular how the men on a lake bulk freighter have accepted this feature of our welfare plan. I would like to set forth at this meeting still another side of the seaman's interest in safety first, which has not only been found helpful in a material way, but has served to keep awake a general interest throughout

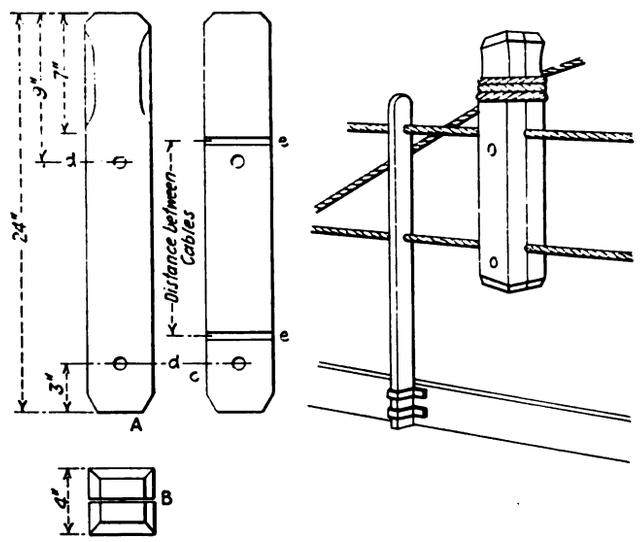

Fig. 1.—Snubbing post for catching mail boat lines on S. S. Hugh Kennedy

A—Front view. B—Bottom view. c and d—Bolt holes. e—Grooves for cables $\frac{1}{8}$-inch smaller than cables and canvas lining.

the fleet. I refer to the inventive thought the men aboard ship have given to this work.

When you find men who will give thought and time to working out devices to safeguard their shipmates from injury or death you may be sure they are keenly interested from a point of view other than one of dollars and cents and that is what the men on our boats are now doing in increasingly large numbers. The ingenuity displayed is indicative of the constructive thought induced by the committee work, and a gratifying phase of the whole matter is that the devices suggested are inexpensive and in every case so far have been made aboard the vessel. In this work they have exhibited mechanical skill, and some of them have proved themselves adept draftsmen.

What makes for a dangerous situation, not encountered elsewhere in seafaring, is the picking up of mail matter in the Detroit River—letters, telegrams and parcels—by vessels both up and downbound. As with very few exceptions all the vessels in the lake trade navigate through this waterway, the government maintains a floating postoffice on the Detroit River and mail is delivered by a small launch to passing vessels under way. In a season of navigation 30,000 vessels pass Detroit and one and one-half million pieces of mail matter are handled. Approximately 9,000 telegrams and special delivery letters are delivered. Although the freighters check to half speed when the launch comes alongside, she is still under fair way and care has to be exercised that the men handling the lines do not sustain injuries or that the launch men are not jerked overboard. In former days the mail boat's painter was held by the sailors on the steamer and occasionally it burned their hands and slipped from their grasp. If it was thrown around a timberhead the mail boat's line was frequently parted by suddenly coming up taut, and consequently the receiving and delivery of important mail in either case was missed.

Snubbing Posts

It was to overcome these last named difficulties that the superintendent of the Detroit River postoffice in 1918 suggested that snubbing posts be installed on the boats. Shortly afterward George F. Anderson, at that time second mate on the bulk freighter *Hugh Kennedy,* sent in a drawing of a snubbing post he had devised. These snubbing posts (Fig. 1) are installed, two on each side, abreast of No. 3 hatch for loaded boats, amidships when the freighter is light. There is little tendency to jerk, as when the mail boat fetches up the spring of the snubbing post on the wire fence relieves the sudden strain on the mail boat's painter. These snubbing posts are now in general use.

Severe injuries were frequently sustained when men were handling the steel hatch leaves for the purpose of oiling the under side. Fingers were pinched and crushed. In order

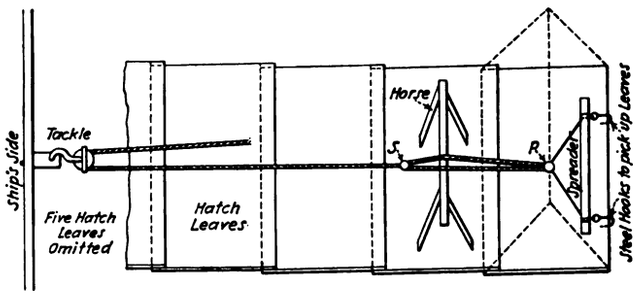

Fig. 2.—Tackle for safely lifting hatch covers

that hatch leaves might be safely lifted for oiling, a clever device was rigged up on the steamer *Augustus B. Wolvin.*

Lifting Hatch Leaves

The device for safely lifting hatch leaves to oil the under side consists of two steel hooks spread 30 inches apart by a spreader. Lines from each end of the spreader connect to the ring P (Fig. 2). The rings P and S are connected by a double line which rides the horse; this horse is about 32 inches high. From S a single line is run to the opposite side of the ship and rove through a tackle.

To lift a leaf: insert the hooks under the outer edge or side of the leaf, set the horse on the leaf next in front of the one to be lifted, throw the double line over the horse and haul on the line.

*From a paper read before the marine section of the National Safety Council, at the annual convention in 1926.

†Secretary-Treasurer, Lake Carriers' Association, Cleveland, O.

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SAFEGUARD AGAINST HOT ASHES AND CLINKERS

We also had reports of burned feet sustained by firemen who stepped on hot ashes and clinkers while cleaning fires. These were so numerously printed in our department of "personal injuries recently reported," that the ship safety committee on the steamer *Sierra* submitted a drawing of a

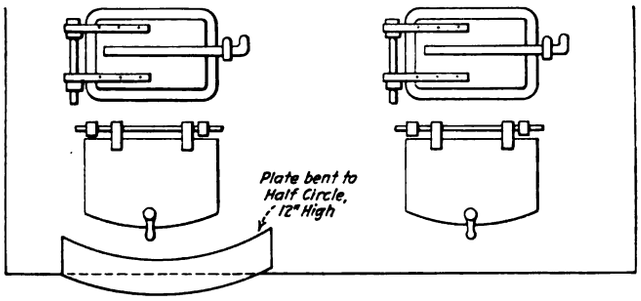

Fig. 3.—A safeguard against hot ashes and clinkers

To be placed in front of furnaces of boilers, while cleaning flues, to prevent clinkers and hot ashes from getting under the fireman's feet.

simple device (Fig. 3) to safeguard firemen from such burns. This device is applicable on steam boats anywhere.

LANDING POLES

Another device, commonly known in the lake trade as a landing pole, is a boom fitted with tackle for the purpose of landing men on the dock at the loading or unloading ports, or on piers at the Sault locks. Until this device was

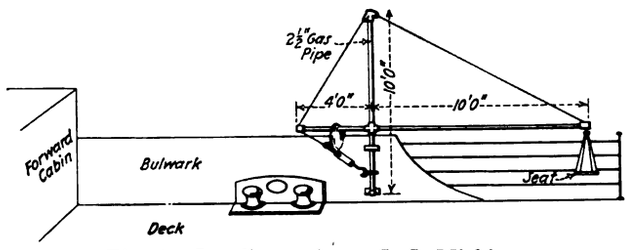

Fig. 4.—Landing pole on S. S. Michigan

brought out the custom of landing men when making a dock was the same as elsewhere; a monkey line was used, or the men went over the rail and jumped for the shore or pier, sometimes falling short and going into the water between the moving vessel and the dock. A number of seamen have been drowned while endeavoring to get on the dock to

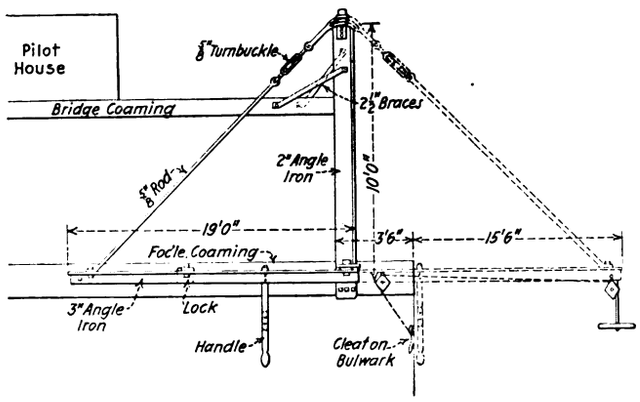

Fig. 5.—Landing boom on S. S. Harry Yates

handle lines, and these fatalities brought forth a description and illustration of a landing pole (Fig. 4) that had been installed fast to the forward bulwarks of the steamer *Michigan*.

This boom not only made it possible safely to land a man in every instance, but to place him on the pier anywhere as soon as the vessel was within 15 feet of it, thus avoiding the frequent bumping of piers and damage to the ship as formerly. The original landing pole was considered light in construction by some vessel managers, and this fault together with the demand for general installation led to the designing of various other types. Under our rules these landing poles are now tested to 800 pounds weight in order that they may be safe beyond possibility of doubt and in time of need be used to hoist barrels of oil, coils of cable and other heavy ship material for which no other provision had been heretofore made.

There are now few, if any, steamers in the membership of the Lake Carriers' Association not equipped with this device. Many vessels in the lake trade and not in the membership of our association are so equipped and this extends to vessels in the Montreal grain trade, where the pole comes in most opportunely when passing through the 60 odd locks of the Welland and St. Lawrence canals.

BAR TO PREVENT BACKWINDING

Also suitable for general application is the attachment of a bar on the hatch engines in a manner to prevent the cables from backwinding on the drum. For a long time the fouling of cables was a source of personal injuries aboard ship. Then the ship safety committee on the steamer *Henry G. Dalton* in 1920 reported that a bar had been fitted on

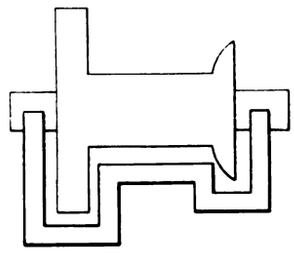

Fig. 6.—Bar to prevent backwinding on drum of hatch engine

the hatch engine of that steamer (Fig. 6) which would prevent the cable from jerking the man carrying the bridle off his feet and possibly into the cargo hold, or, if on the dock, jerking him into the water. Numerous inquiries were received as to how the bar should be fitted to the machinery, thus indicating that the men evinced genuine interest in safety devices.

TO PREVENT PUTTING HEAD OUT OF DEADLIGHTS

Putting his head out of the deadlight was one of the most dangerous practices a lake seaman indulged in. Resultant

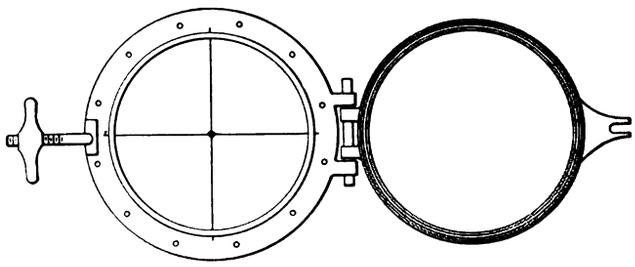

Fig. 7.—⅛-inch steel cross wires prevent putting head out of deadlight

serious injuries were frequently reported; in fact, only a few years ago one of the most competent of our chief engineers was instantly killed when he violated the rules against such practices. As a primary result of this fatality

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the Lake Carriers' Association had stencils made and sent to every ship in the membership in order that a warning against putting heads out of deadlights might be placed adjacent to every deadlight. Inasmuch as all seamen do not observe warning signs we soon received sketches of devices that would serve as a prevention of such practice, one of which is shown in Fig. 7.

In this arrangement ⅛-inch steel wires are set at right angles across the deadlight. The wire sets back ½ inch in

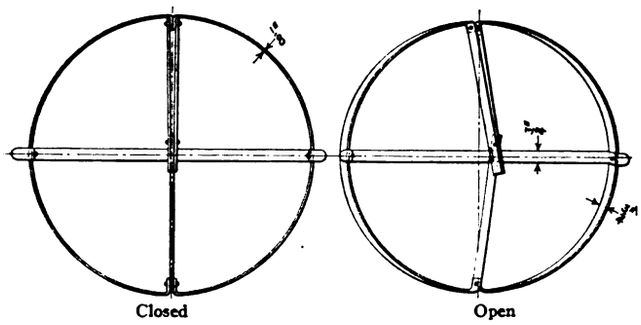

Fig. 8.—Device to prevent putting head out of deadlight

the casting, which entirely clears the opening and closing of the deadlight. The wires are lashed together at the center. Another device for this purpose is shown in Fig. 8.

LADDER GUARDS

Ladder guards, that could profitably be employed on any vessel whenever the ordinary type of ladder is used, are the recent invention of Captain Charles Gegenheimer, master of the 600-foot steamer *Homer D. Williams*. (See Fig.

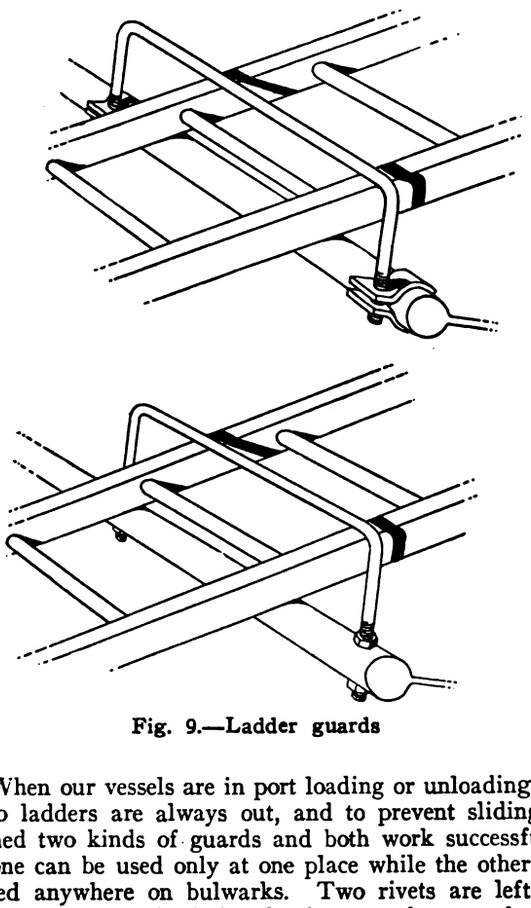

Fig. 9.—Ladder guards

9.) When our vessels are in port loading or unloading one or two ladders are always out, and to prevent sliding he designed two kinds of guards and both work successfully. The one can be used only at one place while the other can be used anywhere on bulwarks. Two rivets are left out of the beading on the bulwarks far enough apart for the ladder to go between and a one-inch rod is bent to fit in the rivet holes and around the outside of the ladder. The rod is threaded on both ends with a lock nut inside of the beading. The bend in the bar must be large enough so as not to bind the ladder. This has to be adjusted to the boat, but will answer the purpose on any dock. The other guard is made with clamps. One-half of the clamp is screwed on an iron rod of three-quarter inch diameter and the other half is held up to the beading with a lock nut.

BECKETS

More personal injuries, often resulting in the amputation of one or more fingers, occur to men who carelessly handle the lines when trying up, or shifting at a dock, than from any other single cause. They have persisted in handling the cable by the eye, instead of the becket that is installed on every ship's mooring line. With the hope in mind that if the man handling the lines had something solid to hold to he would use it, instead of the eye, the captains in the fleet of five steamers of the Bradley Transportation Company adopted a becket made of five-eighths inch iron-rod, bent into triangular shape with 4-inch sides and the ends welded

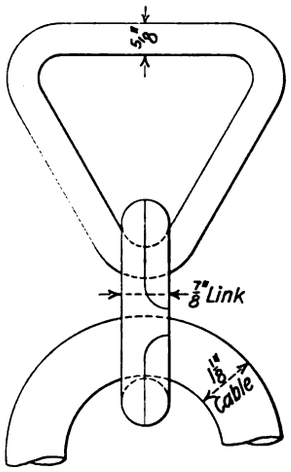

Fig. 10.—Rod iron becket

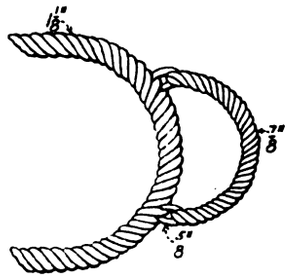

Fig. 11.—Manila becket in use on S. S. Horace S. Wilkinson

together (Fig. 10). This is fitted to the cable by a patent link of a size to slip up and down in the eye of the cable. By this arrangement in the becket the man handling the wire could slide it clear after placing it on the pile. In favor of this becket was also the contention that it could not pull out as a wire becket sometimes does.

Less than a month elapsed, however, before several ship safety committees tore the merits of this contrivance into bits, and I am dwelling on this subject to show that our ship safety men are critical of the devices proposed. They are as equally quick to recognize the practical application and benefits of the meritorious ones. The main objections to this becket were that in the event of the eye of the cable flopping over the bulwarks or the drum and hitting some one it would result in a more serious injury than if the old style becket were used; that there was room for using only one hand and that this iron would be dangerous to use in frosty weather. As a substitute the men on the *H. S. Wilkinson* submitted the drawing of a becket (Fig. 11) that is in satisfactory use on that steamer, and which any sailor can make in a few minutes. It consists of a piece of ⅞-inch manila line, 22 inches long, with eyes spliced in both ends and attached to the cable by means of two ⅝-inch split links placed around a strand of the cable.

In connection with beckets, I may add that our ship safety rule provides, where wire beckets are used, that they be suitably covered with either ½-inch garden hose or canvas, and this recommendation, too, originated on the vessels.

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DEVICE FOR JACKING UP WELL PLATES

The ship invention possessing the greatest merit from a safety first point of view came to us only last year from the steamer *R. L. Agassiz.* It is a jack for jacking up well plates. The cleaning of boilers is always attended by danger if carelessly done and many bad accidents have occurred on the lakes from this cause. In removing manhole plates one man was drawn in by the tremendous vacuum created, others have been scalded by escaping steam and hot water. On one vessel the second assistant engineer and a fireman came very near to being badly scalded by the use of a slice bar, which was generally used in this work. They thought all the water was out of the boiler, but when knocking the manhole plate in they found that the water was not all out. To insure against such a condition this jack was devised on the *Agassiz.* This device, which is illustrated in Fig. 12, holds the plate up and lets the water out while cleaning out top of boiler and it has proved to be very successful.

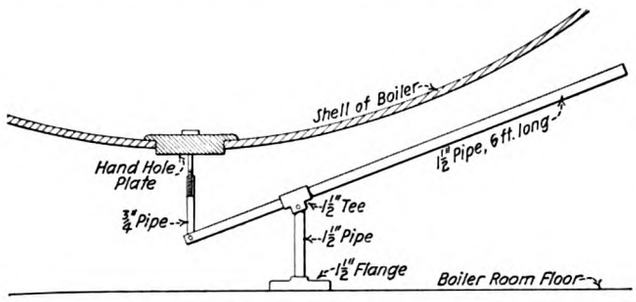

Fig. 12—Device for jacking up well plates, from S. S. R. L. Agassiz

HATCH DEVICE

To keep all the men on one side of the ship and to save too frequently hauling of the cable, a wire pennant was devised by the men on the steamer *William J. Olcott,* as shown in Fig. 13.

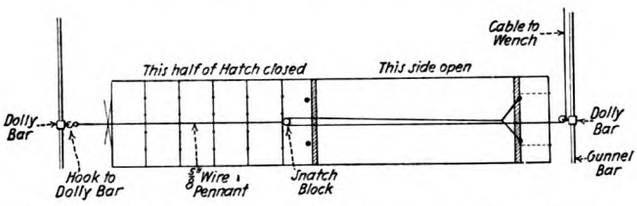

Fig. 13.—Sketch of wire pennant, from S. S. Wm. J. Olcott

TO KEEP THE STEERING ENGINE IN ORDER

When our lake vessels navigate in restricted areas, particularly the rivers and channels, a sudden accident to the steering engine or gear is likely to be attended by disastrous results. In rapid succession a few years ago there were four boats that found the steering engine out of order at a time when it was badly needed. A thoughtful chief engineer, sensing the necessity for some device that would prevent such situations, wrote as follows:

"I do not know that the matter was with the engines, but I do know if they are drilled and pins put in, that about 90 percent of the trouble would be removed.

"On most steering engines only a collar with a half-inch or five-eighths set screw set through it, holds the valves. The constant moving of the valve is very apt to loosen screw and permit the valve to blind the ports. The same is true of the eccentric end.

"The steering engine is a very important piece of machinery and should be kept in first-class shape. There is practically no expense connected with this and it can be done on most any steering engine. It is poor policy to wait until it has done a lot of damage before rectifying, when a few hours of work might save a big bill of expense."

SUGGESTIONS SUBJECT TO APPROVAL

In passing along information of this kind to other engineers in the lake fleet great care is exercised to impress upon them that they are not to accept suggestions as rules to be observed, particularly anything involving fundamental changes that might lead to a deal of harm, and not until approved by our Industrial Committee and endorsed by the Executive Committee of the Lake Carriers' Association.

This year we have had any number of suggestions from the ships in regard to more carefully operating the deck engines in order to prevent parting of the cables and damage to the engine; also suggestions that ropes of various kinds be more carefully kept.

USE OF FLOOD LIGHTS CONDEMNED

And only a few days ago I was much impressed with a complaint that came in from one of the big bulk freighters. The committee on this boat condemned the use of flood lights on the ground of "being dangerous to other ships, especially to ships making a dock and having to pass a ship on which the glare from such lights cause the navigator to misjudge the distance and fetch up against the dock, resulting in damaged plates and fittings." Both vessel owner and underwriter can appreciate this thought.

From what I have recited I think it is clear that our ship safety committees are going on to better and still better work as the years pass on. While it is true that these committees are not employed on all the steamers in the membership, interest in ship safety first is by no means confined to the ships that have committees. A few weeks ago I received two sketches of "safety first" devices from a steamer that never employed a committee.

A New Paint Spray Unit

THE Alexander Milburn Company, 1416-1428 West Baltimore Street, Baltimore, Md., has recently placed on the market a paint spray unit known as the Milburn type E1 siphon-feed outfit. This, with the type E gun, is adaptable to a wide range of painting and will operate efficiently whether using heavy anti-corrosive paints or very thin lacquers. The gun can be adjusted for such fine work as touching-up, shading and high-lighting up to larger work. An ordinary "garage" air compressor affords a sufficient volume of air to operate the Milburn gun. The atomized spray is surrounded by an air pocket which lessens the loss of material, utilizing the entire spray in thoroughly covering the surface. The air, upon entering the purifier, passes through a series of double baffles which extract moisture and other impurities from the air. The unit complete consists of the Milburn type E gun with quart container, air conditioner, air regulator and 25 feet air hose with necessary connections and is built to withstand constant service.

Siphon-feed spray outfit

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Notes on the Effect of Wind on Power and Speed*

An investigation of the effect of wind pressure on the horsepower and speed of different types of ships

By Hugh J. R. Biles

THIS paper deals with effect of the wind pressure in increasing the resistance to motion, and also considers the extra resistance of the rudder when a large degree of helm angle has to be carried to counteract a wind on the bow or quarter. No attempt is made to consider the effect on resistance of rough water resulting from wind.

The procedure adopted has been to assume in each case the wind acting directly ahead, and to assume that the resulting pressure on the vessel can be expressed in the form $K A V^2$, where K is a constant, A is an area, and V is the speed of the vessel relatively to the wind. The value of the constant K adopted throughout has been 0.0043, and the areas have been measured in square feet, velocities in knots, and the resulting pressure in pounds. As a first approximation to the pressure on the superstructure it is usual to measure the transverse thwartship area of the vessel above the waterline and use this for A in the formula above, it being assumed that the frictional air resistance is negligible. The constant K covers not only the pressure on the forward side of the surface but also covers the effect of the rear suction on the surface exposed to the wind. The assumption that the whole of the thwartship area above the waterline is exposed to a head pressure, similar to that on a plane advancing at right angles to the wind, is obviously not correct, for the portion of the vessel between the waterline and the weather deck is of easy form, and it is obvious that the resistance of this portion of the above water structure is usually almost entirely frictional, and is very small in comparison with the head resistance of a plane whose area is the same as the midship area of the vessel between the waterline and the weather deck. On the other hand, when there is discontinuity in the superstructures, and a fair distance between these discontinuous portions, the wind will exert its full force not only on the foremost superstructure but on the ones abaft it which seem to be masked by the leading superstructure. Moreover, if the wind be a few degrees on the bow, then it will exert some effect on discontinuous superstructures, however close together they may be.

The resistance due to air pressure has been estimated for three vessels: one a 10-knot 400-foot cargo vessel of about 8,000 tons deadweight, of the poop, long bridge and forecastle type; the second a 20-knot passenger liner of about 650 feet length; and the third a 20-knot cross-Channel steamer of about 320 feet length. Before giving the results of these estimates of wind pressure it will be as well to outline how the calculation has been made.

Cargo Steamer

The forecastle has been taken as having a rear suction effect only and no pressure effect. This is accounted for by taking half the area of the after end of the forecastle instead of the whole area. The bridge space has been taken as having the full pressure and suction effect. In the case of the poop, the area of the fore-end of the poop has been multiplied by three-fourths to represent full pressure on the front of the poop, and a suction effect on the after-end of the poop equal to half that of a flat surface. None of the houses on the bridge deck in any way mask each other, and they have been taken in a straightforward way. The funnel effect has been taken as equal to half that of a rectangular shaped funnel. Frictional resistance was also estimated and found to be about 3 percent of the head resistance, and an addition of 2 percent was also allowed for fittings, viz., deck machinery, ventilators, rigging, rails, boats, skylights, etc., and 2 percent allowed for air eddies round the counter of the vessel.

Passenger Liner

A similar procedure has been adopted in this case, the only difference in the results being that as most of the superstructures and houses were continuous, or with very small gaps between them, the forward superstructures were in general the only ones that were reckoned as acted upon by the full force of the wind. The funnels were treated in exactly the same way as the cargo vessel, except that there was a sufficient interval between the funnels to allow the full pressure acting on all of them. In this case the frictional air resistance was found to be about 4 percent of the remainder. Eddies round the stern were estimated at 2½ percent and deck fittings at 2½ percent.

Cross-Channel Steamer

The method of estimating was similar to the two previous cases. The frictional resistance in this case was estimated to be 3¾ percent of the total, but owing to a very square stern the estimate for the stern eddies resulted in an addition of 6¾ percent to the total. Two and a half percent was again added for the resistance of fittings, etc.

In Tables I, II and III are given for the three vessels the estimated resistance in pounds due to wind pressure corresponding to various relative speeds of wind and vessel. In addition, a column is given which shows the percentage that this air resistance bears to the naked resistance at load draft of the ship, at 10 knots in the case of the cargo vessel, and at 20 knots in the cases of the two other vessels. As an example, it will be seen from Table I that if there is a 20-knot head wind blowing then the relative speed of ship

TABLE I—CARGO VESSEL. *Air Resistance Due to Wind of Velocity* V *Relatively to Ship*

V, Knots	Resistance, Lb.	Percent Air Resistance / Naked Resistance at 10 Knots
5	207	0.8
10	829	3.1
15	1,870	7.0
20	3,315	12.3
25	5,180	19.25
30	7,450	27.7
35	10,150	37.7
40	13,260	49.3
50	20,700	77.0
60	29,900	111.0

TABLE II—LINER. *Air Resistance Due to Wind of Velocity* V *Relatively to Ship*

V, Knots	Resistance, Lb.	Percent Air Resistance / Naked Resistance at 20 Knots
5	385	0.2
10	1,540	0.8
15	3,460	1.8
20	6,170	3.25
25	9,640	5.1
30	13,870	7.3
35	18,900	10.0
40	24,700	13.1
50	38,550	20.4
60	55,500	29.4
70	75,600	40.0

* Paper read at the spring meetings of the sixty-eighth session of the Institution of Naval Architects, London, April 8, 1927.

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TABLE III —CROSS-CHANNEL STEAMER. *Air Resistance Due to Wind of Velocity* V *Relatively to Ship*

V, Knots	Resistance, Lb.	Percent Air Resistance / Naked Resistance at 20 Knots
5	114	0.25
10	455	1.0
15	1,024	2.3
20	1,820	4.1
25	2,840	6.35
30	4,090	9.15
35	5,575	12.5
40	7,280	16.3
50	11,380	25.4
60	16,380	36.6

to wind will be 30 knots; the resistance in pounds will be 7,450 pounds, and the percentage of this to the naked resistance of the cargo vessel at 10 knots will be 27.7.

It will be noticed that the effect of wind is to increase the total resistance of the ship by a greater percentage in the case of the cargo vessel than in either of the other two cases. This is principally due to the fact that the resistance of the cargo vessel is small compared to the surface exposed to the wind. For instance, the thwartship area above the load waterline of the cargo vessel in case (1) is 1,685 square feet as against 5,270 square feet in the case of the liner, and 2,100 square feet in the case of the cross-Channel steamer. The corresponding resistances are: 27,000 pounds for the cargo vessel at 10 knots; 189,000 pounds for the liner, and 45,000 pounds for the cross-Channel steamer at 20 knots. Moreover, the superstructures in the liner and cross-Channel steamer mask each other much better than in the case of the cargo vessel.

If the wind is on the bow it is not uncommon for quite large angles of helm to be required to keep the vessel on her course. The following estimates have been made from the results of model experiments on rudders, and the estimates give the added resistance due to helm angles of 10 and 15 degrees. The figures are based principally on Messrs. Baker and Bottomley's papers on rudders behind single screw and twin screw vessels, and on Mr. Denny's paper on spade rudders.

In the case of the cargo vessel, the formula used in calculating the normal pressure on the rudder is the one given by Mr. Bottomley in the paper he read this year before the Institution of Engineers and Shipbuilders in Scotland. This is:

$$P_{normal} = K A^{1.04} V^{1.85}$$
$$\text{at } 10^\circ \quad K = 0.55$$
$$15^\circ \quad K = 0.78$$

From this formula the pressure on the rudder of this vessel with 10 degrees of helm would represent an increase of 4.35 percent to the naked resistance at 10 knots, and with 15 degrees helm an increase of 9.35 percent. The ratio of area of rudder for this ship to length multiplied by draught is as 1:70.

In the case of the liner the rudder pressures were calculated from the results of Mr. Bottomley's 1924 paper to the Institution of Engineers and Shipbuilders in Scotland. These are for a vessel of 0.76 prismatic coefficient, and it is probable that the actual pressures for this liner would be higher as she was a good deal finer than Mr. Bottomley's form. One of Mr. Bottomley's future papers will probably clear this up. The calculated results show that at 10 degrees helm the naked resistance at 20 knots is increased by 1.6 percent and at 15 degrees by 3.7 percent.

In the case of the cross-Channel steamer the estimates of rudder resistance were made from Mr. Maurice Denny's paper on Spade Rudders (Trans. I.N.A., 1920). At 10 degrees helm the resistance is increased by 2 percent and at 15 degrees by 3 percent.

It will be seen, then, that the increase of resistance due to direct wind effect and rudder is most serious in the case of the cargo vessel.

It is not always realized to what an extent a wind can upset measured mile trial results. An example may best illustrate this. Referring to Table I, which gives the wind pressure results for the cargo vessel, it will be seen that if the vessel meets a 20-knot wind when she is herself doing 10 knots, the resistance due to a relative wind speed of 30 knots will be increased by 27.7 percent. On the return run the relative wind speed will be 10 knots following, and the resistance will be decreased by 3.1 percent. That is to say, that for a pair of runs at 10 knots each way the mean increase of resistance due to wind pressure will be $\frac{27.7 - 3.1}{2}$ = 12.3 percent. It will be seen from Table I that if there had been no wind on the mile the increase of resistance at 10 knots would have been only 3.1 percent, a difference of 9.2 percent. That is to say, that if this cargo vessel were run on the mile on a day when there was a 20-knot wind blowing down the mile, the mean resistance and horsepower for a pair of runs would be 9.2 percent higher, due to a greater wind pressure than on a calm day. As the wind speed rises so this percentage will rise.

If the wind is not directly down the mile, but is in such a direction that on one run it is a little on the bow, it will have the effect of increasing the wind pressure resistance, due to the additional resistance of parts of the superstructure previously masked by the wind. In addition a certain amount of helm will be required to counteract the tendency of the wind to turn the vessel off her course. It was shown above that with a helm angle of 10 degrees the resistance of the cargo vessel was increased by 4.35 percent, due to extra rudder resistance. It is not unknown for this degree of helm to have to be carried to counteract the wind effect, so that it will be seen that for a cargo ship under fairly normal trial trip conditions the mean resistance and power for a pair of runs may be increased by 9.2 percent, due to wind pressure plus 4.35 percent due to helm. On a bad day the results will be considerably worse.

Measured mile trials have two main purposes: one is to satisfy the owner that he has got what he is paying for, and the other is to give the shipbuilder data on which he can make future estimates and designs. Margins of power have always to be provided to balance the fact that service conditions are always worse than trial ones, and no analysis of trial results will reduce the fact that from 20 or 25 percent margin over the trial power is required for service conditions.

Analysis of trial results is very necessary to check estimates of power and speed, to balance up theory with practice, and to compare performances of one form and propeller against others. This is the justification for suggesting that shipbuilders might take on the extra work on trial trips of noting wind velocities and directions, and helm angles, and estimating how much power they have thus lost. This will assist in the comparison of performances on a fine weather basis, which is the only practicable one.

SHIPBUILDING has been issued as part of the documentation of the International Economic Conference, which began its sessions at Geneva on May 4. The document was prepared by the Economic and Financial Section of the League of Nations from information furnished to it by governments, by members of the Preparatory Committee for the Conference and by industrial organizations, which prepared memoranda at the request of members of the committee. The salient phases of the subject and its international aspects are examined from this mass of information, and the statistical tables and summaries, as a consequence, are the most comprehensive, authentic and up-to-date available. The memorandum is obtainable from the American agent for publications of the League of Nations, World Peace Foundation, 40 Mt. Vernon Street, Boston, Massachusetts.

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A High Speed Double Acting Diesel

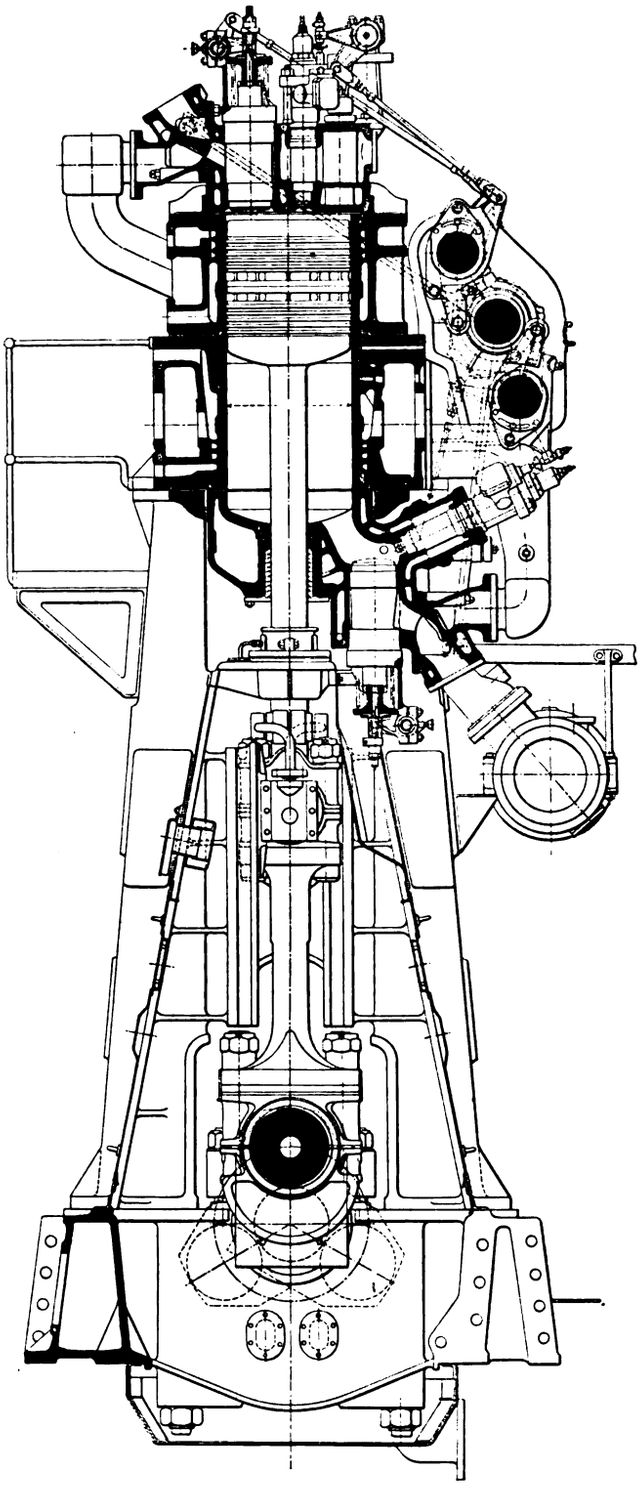
Points in the Tosi Design

By F. Johnstone-Taylor

ONE naturally associates the double acting Diesel with a heavy slow moving unit running at about 100 revolutions per minute and driving direct, of course, on to the propeller shaft. Geared Diesels, that is those driving the shaft through some form of hydraulic transmitter such as the Vulcan, have not so far been employed to any considerable extent though the system undoubtedly has its merits principally in the use of a relatively light engine. The employment of a double acting engine designed for a speed of 240 revolutions per minute is quite a novel departure from orthodox practice in this direction and is due to the initiative of the British firm of Beardmore who build Diesels to the Tosi design. Moreover the engine functions on the four stroke cycle and yet for the power developed it is relatively light. The particular unit, of which a sectional view is shown on this page, is one of two for a conversion job, the *Wulsty Castle,* a single screw vessel previously equipped with a turbo electric set. Each engine, which has three double acting cylinders, is rated at 800 horsepower at 240 revolutions per minute, the bore and stroke being 20 inches and 20¾ inches, respectively.

The illustration makes clear the general construction of the cylinder which is built up in two portions, the bottom half being fitted into the entablature of the engine. The latter takes the form of a box girder, supported on the eight columns of the engine, though the actual liner is held in position by the bottom cover. The top portion on the other hand is supported in an individual steel casting bolted to the top face of the entablature and there is actually a space of one millimeter between the two liners, though this becomes negligible when the engine is at normal running temperature. The drawing shows the single cam shaft, there being only one valve to each end of the cylinder. This of course is the principal feature of the Tosi design, which so far as the actual poppet valve is concerned requires only one for the handling of both air and exhaust gases. That is to say taking the bottom valve of the engine as illustrated, the poppet valve is just about to open to exhaust giving the gases a free passage down to the exhaust pipe below it on the right. As soon as the piston commences its up stroke (suction) the little flap seen in the bend just to the right of the valve cage is swung over by the eccentric rod shown in dotted elevation thus opening the branch to the air suction manifold. The same arrangement may be seen at the extreme top left of the drawing, where this flap, which is termed the "director" valve, is seen in its mid position.

As stated this particular arrangement is the essential feature of the Tosi design for which several advantages are claimed and it has now been in use for some years. In the engine in question its particular advantage becomes apparent by the way it facilitates the formation of a simple combustion chamber pocket in the lower cover. This pocket, as readers will be aware, is a feature of four stroke double acting engines, principally dictated by its being necessary to keep as much heat as possible away from the rod and its gland. With only one valve besides the fuel valve, the bottom combustion chamber can be considerably simplified. On the top head are the main and fuel valves as shown and behind them are two starting air valves, starting air being admitted only to the top half of the engine. These valves are so operated from the cam shaft that the engine works "two stroke" on starting air, while reversing is effected by the usual arrangement of double cams and a sliding cam shaft. Another point which will be apparent is that when the upper half of the cylinder and its jacket casting are removed, the piston when at the top of its stroke is wholly exposed for inspection, and the removal of the parts mentioned is quite an easy matter as they are comparatively light in weight.



Section through Beardmore-Tosi double acting four stroke Diesel engine

Altogether the engine is a light compact unit marking quite a new departure in Diesel engine design, in that it permits of a relatively light and simple double acting engine being built to operate economically on the four stroke cycle.

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Questions and Answers for Operating Engineers

Practical information for marine engineers on the operation and maintenance of boilers, engines and auxiliaries

This department is maintained to help those who desire practical information regarding engine room problems or who are preparing to take examinations for a marine engineer's license. Readers are urged to send in questions. Inquiries bearing the name and address of the writer will be answered promptly by mail. If the question is of general interest the answer will also be published in an early issue of the magazine, although the identity of the writer will not be disclosed in doing so. Anonymous communications will not be considered.

How Propeller Is Secured to Shaft

Q.—How is a screw propeller fixed on the shaft and what means are used to prevent it getting loose at sea?

A.—The propeller is fitted tightly on the taper end of the shaft with the feather keys in the shaft, and held secure by a large nut. A check plate is fitted on the boss by tap bolts to prevent the nut getting loose.

Sluice Valves

Q.—Where are sluice valves placed and what attention should they receive?

A.—Sluice valves are placed low down on each watertight bulkhead for the purpose, when necessary, of draining the bilge water from the various holds towards the engine room. They should be kept in good working order for immediate use.

Engine Lagging

Q.—What parts of an engine or its fittings should be felted or otherwise protected from radiation?

A.—All cylinders, steam chests, steam pipes, feed pipes and valves should be felted to prevent the loss of heat by radiation. The boilers should also be protected for the same reason.

Balance Cylinders

Q.—What are the small cylinders sometimes fitted on the slide valve casing cover of vertical engines? Explain their action. To what are they connected by a pipe and why so connected?

A.—The small cylinders on the top of the steam chest are called balance cylinders, because the weight of the slide valve, rods, etc., are balanced by the pressure of the steam on the bottom side of the piston in the balance cylinder. The piston is connected to the tail rod of the slide valve spindle. A pipe leads from the top of the balance cylinder to the condenser, so that any steam that passes the piston is condensed in the condenser and a vacuum maintained on the top of the balance piston.

Economy of the Surface Condenser

Q.—What is the explanation of the economy of the surface condenser?

A.—With surface condensing the water from the condensed steam is not affected by the sea injection, but it is fresh and free from scale forming matters and can be used over and over again, therefore giving hotter feed water which takes less fuel to evaporate it. The vacuum enables the engine to develop more power.

Density of Steam

Q.—What is meant by the density of steam?

A.—The amount of water that is held in the steam.

Boiler Scale

Q.—What are some of the causes of scale forming in a boiler?

A.—Salt, lime, soda and magnesia form into a hard scale by heat.

Preventing Radiation Through Smokebox Doors

Q.—What provision is made to lessen the amount of radiation in the construction of smokebox doors?

A.—A light plate forming an air casing is fitted on smokebox doors, held off about 3 inches by thimble pieces and bolts to allow free circulation of the air, to lessen the radiation.

Lagging Materials

Q.—What non-conducting substances are employed to prevent radiation?

A.—Felt, cement and asbestos.

Effect of Water in Ammonia Refrigerating Plant

Q.—What objection is there to the presence of water getting into ammonia in a refrigeration plant?

A.—The water in ammonia may form ice and obstruct or choke the suction pipes and valves. The water will also absorb a certain amount of the ammonia and render the plant less efficient.

Maximum Pressure in Ammonia Ice Machine

Q.—In the compressors of ammonia ice machines what is the maximum pressure?

A.—The pressure rarely exceeds 200 pounds per square inch.

How to Tell When an Ammonia Drum Is Empty When Charging an Ice Plant

Q.—When charging an ice plant how can you tell when the ammonia drum is empty?

A.—When drum is nearly empty a frost will form on its surface but will soon disappear, which is an indicattion that the drum is empty.

Marine Motors

Q.—Name some of the special features of marine motors.

A.—The windings of motors for marine purposes are given special treatment to increase their resistivity to the action of salt air, moisture and oil. The field windings are usually impregnated with a special compound by the pressure-vacuum method. This method insures the complete removal of air and moisture from the windings and all spaces are filled with the compound. The armature windings are also given several dippings in a special moisture-resisting varnish and are baked in an oven for long periods after each dipping. All bolts, brush holders, washers and

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oil gages are either copper plated, galvanized or brass. Stuffing boxes or felt gaskets are provided around the shaft to prevent the escape of oil while the ship is rolling or pitching.

Knocks in Diesel Engines

Q.—What are the principal sources of knocks in the Diesel engine?

A.—Knocks may develop in the large bearings, the valve gear or the interior of the cylinders. Bearing knocks are caused by too much clearance. Valve gear knocks may be caused by excessive roller clearance, worn or broken rollers, or sticking valve stems. Knocks inside the cylinder are caused by too early injection, excessive lift of spray valve at low speed, spray air pressure too high or stuck piston rings.

Bearing Adjustment

Q.—What is the elementary principle of bearing adjustment?

A.—The adjustment of any bearing with split bearing boxes consists of decreasing or increasing the separation between the two halves of the box, so that the clearance between the bearing and shaft, or the difference in the diameter of the box and the bearing surface of the shaft, will be great enough to permit the maintenance of an adequate film of oil and small enough to prevent pounding.

Adjusting Bearing Boxes

Q.—How is the separation of the two halves of a bearing box usually obtained?

A.—By placing sheet metal shims between the abutting surfaces.

Method of Checking Shaft Alinement

Q.—What is the best method of keeping a check on crank shaft alinement and main bearing wear?

A.—By the use of a bridge gage, on which are stamped the heights of the crank shaft at the main bearings at the time the engine was installed. Periodical measurements with this gage, compared with the original measurements, will indicate any dropping of the shaft.

Precautions When Receiving Fuel Oil Aboard Ship

Q.—What precautions should be taken when receiving fuel oil aboard ship?

A.—While fuel oil is being received on board, no naked light, smoking, or electrical apparatus liable to spark should be permitted within 50 feet of an oil hose, tanks, or compartment containing tanks or the vents from tanks. All tanks should be closely watched for leaks and overflowing, as far as possible.

Classification of Fuel Oil

Q.—How is fuel oil generally classed?

A.—Fuel oil may be classed as topped petroleum, that is, the residue after the more valuable and volatile constituents have been removed by distillation leaving a heavier and safer oil for burning purposes.

Electrical Terms

Q.—Give a definition to the following electrical terms: One kilowatt, one horsepower, one watt-hour.

A.—One kilowatt is equal to 1,000 watts. One horsepower is equal to 746 watts. The watt-hour is a unit of work and is equal to one watt expended for one hour. A larger unit is commonly used and is called the kilowatt-hour. It is equal to the expenditure of 1,000 watts or one kilowatt for one hour.

Starting a D. C. Generator

Q.—What care should be taken in starting a direct current generator?

A.—See that the bearings are well oiled and that the oil rings are free to turn. Inspect all connections for loose screws or wires. Start slowly and see that the oil rings are revolving properly. Turn in all resistance in the field rheostat, then bring the machine up to speed, adjust the rheostat for the normal voltage of the generator and then throw on the load.

Causes of Insufficient Voltage

Q.—What are some of the causes of insufficient voltage?

A.—The speed of the generator may be below normal, the switchboard instruments may be incorrect and the voltage may be higher than that indicated or the current may be greater than is shown by the readings. The brushes may be incorrectly set or the series field may be reversed or part of the shunt field reversed or short circuited. A part of the field rheostat or other unnecessary resistance may be in the field circuit.

How to Change Polarity of Generator

Q.—How would you change the polarity of a generator?

A.—If a generator keeps the same rotation, it is necessary to reverse the magnetism in the field circuit which is done by exciting the shunt field in the opposite direction.

Shutting Down a Generator

Q.—How would you shut down a generator?

A.—Reduce the load as much as possible by throwing in resistance with the field rheostat, throw off the load by opening the circuit breaker, if one is used, otherwise open the feeder switches and finally the main generator switches, then shut down the driving machine and wipe off all oil and dirt and put everything in good order so the machine will be ready to start when next needed.

Temporary Repairs in Pipe Lines

Q.—Please discuss temporary repairs in pipe lines.

A.—Prepare a patch, generally of the gasket material used between the pipe flanges of the line in question. Back this up with sheet metal and secure in place with bolted metal band clamps.

Red lead putty wrapped with canvas and served with electric friction tape is satisfactory for and easily applied to low pressure salt water piping.

Portland cement can be cast in place and secured by bands.

Soft pine plugs can sometimes be used for small leaks.

Jerky Operation of Reciprocating Pump

Q.—What does jerky operation in a reciprocating pump indicate?

A.—Such operation probably indicates a failure to take suction. The following procedure is suggested:

Be sure that all stop or check valves in the suction line are open and that there are no obstructions in the line.

If pump has a suction lift, priming may be required.

Evaporative Power of Oil and Coal

Q.—How does the evaporative power of fuel oil compare with that of coal?

A.—Admiral Dyson in "Practical Marine Engineering" states that careful tests have shown that in general one pound of petroleum does the work of 1¼ pounds of coal and that oil occupies 40 percent less bunker space than coal.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Dry Docks

Q.—Please give me some information as to the relative merits of graving and floating docks.

A.—The graving dock is in more general use than the floating dock, partly at least because it has been known to shipbuilding for a greater length of time. The floating dock is a development of comparatively recent years.

The graving dock costs more to construct than the floating dock by perhaps 20 to 30 percent, depending somewhat upon the character of the material which has to be removed during construction and the work necessary to secure proper foundations. However, its operating and upkeep charges are materially less than those of the floating dock.

Most floating docks are constructed in sections to facilitate cleaning and making repairs. It results that in docking and undocking ships the greatest care in pumping must be exercised to avoid overstraining either the dock or the ship structure. Further, the problem of centering the ship in the dock, and the maintaining of satisfactory stability while pumping, requires a high grade of technical knowledge and experience not essential in operating the graving dock.

Proportions of Vessel to Insure Stability

Q.—Please describe a method of proportioning a vessel so as to insure adequate stability.

A.—This is one of the important problems of preliminary design. The first step is to find a standard of measurement and the next to decide for the ship in question what may be considered adequate stability.

For ships of a well-defined type it is sometimes sufficient to proportion the new vessel directly by means of an accepted rule which fixes the beam in terms of some other dimension such as length. Such a rule, applicable to cargo vessels of moderate size, follows:

$$B = \frac{L}{10} + 13$$

Here B is beam and L is length.

With this or a similar method it is essential that no features are introduced in the new vessel which destroy or seriously alter her similarity to the type represented by the rule. With such a method the stability of the new ship is measured by comparison with other vessels of her type which have shown satisfactory stability characteristics in service.

A second method is that in which the value of the metacentric height, the vessel being in designed service condition, is taken as the standard of comparison.

Let G be the center of gravity of the ship.
M be the transverse metacenter.
B be the center of buoyancy.
K be the bottom of keel.
H be the draft in feet.
L be the length on waterline in feet.
B_1 be the beam
b be the block coefficient.
p be the water plane coefficient.
α be the inertia of water plane coefficient and equal to $\frac{I}{LB_1^3}$.

Then $\overline{GM}$ is the metacentric height in feet.

$\overline{BM}$ is the distance between metacenter and center of buoyancy in feet.

$\overline{KB}$ is the distance between keel and center of buoyancy in feet.

$\overline{KG}$ is the distance between keel and center of gravity in feet.

Then for the new ship assume or estimate the value of $\overline{KG}$.

Select a value of $\overline{GM}$ suited to the type and size of ship in hand.

Then $\overline{GM}+\overline{KG}=\overline{KM}$, the required height of M above the keel.

But $\overline{BM}+\overline{KB}=\overline{KM}$. (1)

Both $\overline{BM}$ and $\overline{KB}$ are form features and independent of weights or center of gravity.

The feature most closely associated with the initial stability of a ship is the beam. The required value of the beam is deduced from the above expression, equation (1) as follows:

$$\overline{BM} = \frac{I}{V} = \frac{LB_1^3\alpha}{LB_1\ H\ b} = \frac{B_1^3\alpha}{H\ b} \qquad (2)$$

$$\overline{KB} = H - \frac{1}{3}\left(\frac{H}{2} + \frac{LB_1^3\ Hb}{LB_1\ p}\right) = \frac{5H}{6} - \frac{Hb}{3p} \qquad (3)$$

$$\text{and } \overline{KM} = \frac{B_1^3\alpha}{Hb} + \frac{5H}{6} - \frac{Hb}{3p}$$

$$\text{whence } B_1^2 = \frac{Hb\ (6\ \overline{KM}p - 5Hp + 2Hb)}{6\alpha p} \qquad (4)$$

There follows a table of ranges of values of metacentric height which are considered satisfactory for certain types of ships. The values of b, p and α vary with the type of ship and are to a minor extent subject to the control of the naval architect.

Type	*GM in Feet*
Battleships	5 to 8
Light cruisers	3 to 5
Destroyers	1.5 to 2.5
Harbor tugs	1.5 to 2.0
Seagoing tugs	2.0 to 2.5
Passenger-cargo vessels	2.0 to 3.0
Oil tanker light	7.0 to 8.0
Oil tanker loaded	3.5 to 4.5

The method just outlined is, of course, far more satisfactory for general use than the first one indicated herein,

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because it makes possible the adaptation of dimensions and form to the requirements of individual differences between several ships of the same general type. Moreover, it is based upon a definite unit of measurement, the metacentric height.

However, it is necessary to carry the investigation of the effect of form much further than is indicated above, if adequate stability is to be insured under all conditions for certain types of ships.

If variation in draft due to different conditions of loading, as in cargo vessels, is great, or if there is marked change in form between the light and deep load, as in vessels with high bilges, the values of GM in the extreme conditions should be investigated. If the center of gravity in any condition of loading is relatively high above the waterline, so that the ratio $\frac{KG}{H}$ is greater than 1.5, the value of righting arms at large angles of inclination should be investigated. Also, if a vessel is to be given relatively large beam and low freeboard so that the deck edge is immersed at small angles of heel, it should receive particular attention. Further, the effect of damage by which large compartments are opened to the sea should be studied whenever practicable.

All the above investigations do not fall strictly within the preliminary design range. However, all design should be carried out, wherever possible, with due regard to the information obtained by means of such investigations.

LETTER TO THE EDITORS

The Most Important Thing in Welding

LONG ISLAND CITY, N. Y.

TO THE EDITORS:

I notice in your April, 1927, issue a letter from Mr. M. M. Gooch in regard to my article on "The Most Important Thing in Welding." There will always be differences of opinion in regard to any matter, and these differences are usually largely dependent on the point of view.

My original statement was that the most important thing in welding is procedure control, which includes all the items entering into a welded job.

My experience in welding leads me to believe that this statement is correct. I would point out, in regard to the remarks of Mr. Gooch concerning tests, that the requirement of the A. S. M. E. pressure vessel code is that the test pressure be raised to three times the working pressure and held there for three minutes. This is also the test that many oxy-acetylene tanks, which were made in various contract shops for the use of our constituent companies, have been subjected to, and this test had no effect whatever on the welds in any of these tanks.

It should also be made clear that the severity of this test depends entirely on the fiber stress created by the pressure. If a tank is designed for a 5,000-pound working pressure, a test at three times the working pressure produces a fiber stress of only 15,000 pounds, which is very moderate.

The tanks, which we have had built for our own use, were tested at the beginning of our work to 21,000 pounds fiber stress; but at the present time they are tested to 27,000 pounds fiber stress, which we find to be without effect on the welded joint.

I doubt if at any time tanks have been tested to a higher fiber stress than 27,000 pounds, which of course does not exceed the yield point or elastic limit of the material we are using, which is firebox steel, meeting the requirements of the A.S.M.E. code. Of course, no riveted construction would stand such a fiber stress without injury.

I might also say that the A.S.M.E. power boiler code does allow the use of forge welded boiler shells under certain restrictions as to fiber stress.

Paragraph P-186 states as follows:

"The ultimate strength of a joint which has been properly welded by the forging process shall be taken as 35,000 pounds per square inch, etc."

The A. S. M. E. unfired pressure vessel code also permits the use of forge welding for pressure vessels in Section U-82, but they have increased the working fiber stress to 8,000 pounds. The requirement for tests on forge welded and riveted construction is 1½ times the working pressure.

We have shown in our own work, and it is also clear from the tests in Bulletin No. 5 of the American Welding Society, that the welds made under procedure control are perfectly safe under a test of three times the working pressure, so that fusion welding cannot be so bad after all.

S. W. MILLER.

NEW BOOKS

DIESEL ENGINES. Third edition. By Arthur H. Goldingham. Size, 5½ by 8¾ inches. Pages, 255. Illustrations, 185. London, England, 1927: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain.

This book is intended to serve consulting engineers, draftsmen, practical engineers, students and owners of Diesel engine plants. It deals with the design and construction of both marine and stationary Diesel engines, the subject being introduced with the first principles and theory of Diesel engineering. The advantages and disadvantages of various types of engines are classified and compared which is intended as an aid in determining types best suited for specific needs. Testing, operation and correction of Diesel engines are subjects exhaustively treated in the book.

DIRECTORY OF SHIPOWNERS, SHIPBUILDERS AND MARINE ENGINEERS, 1927. Twenty-fifth edition. Compiled under the direction of the editor of *Shipbuilding and Shipping Record*. Size, 5¼ by 8½. Pages, 802. London, England, 1927: The Directory Publishing Company, Ltd.

The annual edition of this directory has been amplified over previous volumes. It contains lists of the leading steamship companies, shipbuilders, ship repair yards and marine engineering works throughout the world. It also contains the names of directors and principal officials of each company where available and details of the fleets owned by the shipping companies. A special section is devoted to a list of consulting marine engineers and naval architects throughout the world. A list of societies, institutions, trade and labor federations is contained in a supplementary section of the book. At the end of the volume are exhaustive indices covering over 24,000 entries and a special new feature is an index of telegraphic addresses.

ELEMENTARY STEAM ENGINEERING. Second edition. By E. V. Lallier. Size, 5 by 7¾ inches. Pages, 288. Illustrations, 116. New York, 1926: D. Van Nostrand Company.

The first edition of this book was published in 1913. It deals with the fundamental elements of heat engineering with special reference to steam. The work covers a study of fuel, boiler calculations and design, various types of engines and their accessories with calculations, pipes and fittings, auxiliary apparatus and the like. The second edition was prepared to incorporate the many improvements

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which have been made in engineering methods and apparatus during the past few years. Where methods of construction have been changed and in many cases standardized the economies effected and the efficiency of operation developed are given considerable attention in this volume. As indicated by the title, the work is designed for the use of students and young engineers who will find it of assistance in acquiring a fundamental knowledge of the profession of steam engineering.

STEAM TURBINES. By Giuseppe Belluzzo. Translated by Engr. Captain A. G. Bremner, O.B.E., R.N. Size, 6 by 9 inches. Pages, 746. Illustrations, 742. London, England, 1926: Charles Griffin & Company, Ltd.

This work is by an eminent continental expert on steam turbines who holds the post of Professor of the Polytechnic, Milan, Italy. The treatise deals extensively with design and construction of steam turbines in all their details and applications and gives summaries of experimental research as carried out by the author and by other investigators. It also contains a number of useful numerical examples of the calculations to be made in designing various types of turbines. The book is divided into 5 parts, the first dealing with the thermodynamics of steam as affecting the steam turbines, the second with the calculation of steam turbines, the third part with the construction of steam turbines, the fourth with the application of steam turbines to marine propulsion and the fifth with the application of steam turbines for railway traction.

CORROSION: CAUSES AND PREVENTION. By Frank S. Speller, D.Sc. Size, 5½ by 9 inches. Pages, 611. Illustrations, 125. New York, 1926: McGraw-Hill Book Company, Inc.

The aim of this work has been to combine a useful reference book for those interested in the many phases of corrosion with a handbook for the engineer and architect who may desire only a practical knowledge of the developments in the prevention of corrosion. The subject matter has been written with particular reference to the ferrous metals. Each chapter has been made reasonably complete in itself as far as possible without undue repetition. The work was undertaken with the conviction that the conservation of metals is becoming more and more one of the main problems of the present day and that a more general knowledge of the underlying principles of corrosion prevention is necessary for the elimination of waste. The efforts of the author were encouraged and aided by the Corrosion Committee of the National Research Council and others interested in the subject. The general subject and fundamental principles of the corrosion problem, including the nature and mechanism of corrosion and their theories, the influence of methods of manufacture and treatment of metals, methods of corrosion, testing and similar subjects are treated in the first part of the volume. The second section is devoted to the development of preventive measures.

PERSONAL MENTION

J. A. BOUSLOG has been appointed general agent for the United States Lines in the Chicago district. The new district office will be in the Union League Club building, 61-63 West Jackson Boulevard.

DANIEL A. BEATON has been appointed first assistant engineer of the steamship *President Garfield* of the Dollar Steamship Line, San Francisco, by chief engineer William D. Schoningh; at the same time Olaf Mitskog was made second assistant, Frank W. Krause third assistant and Everett A. Smith fourth assistant on this vessel.

EMIL VOLLMER was recently appointed first assistant engineer and Walter Gowen second assistant engineer of the steamship *Eldorado* operated by the Western Transportation Company, Portland, Ore.

N. H. CASSELL, formerly first assistant of the steamship *Matsonia* operated by the Matson Navigation Company, San Francisco, has been promoted to the post of chief engineer of the steamship *Mahukona.*

J. G. EUSON, district manager at Portland, Ore., for the Luckenbach Steamship Company, Inc., has been appointed district manager at Seattle for the company, succeeding Captain Paul D. Chandler, resigned.

SHIPPING BOARD COMMISSIONER HILL, whose term expires June 8 is to be reappointed. Mr. Hill was appointed early in 1924 to fill the unexpired term of Albert D. Lasker, former chairman of the board, resigned.

A. S. MORRISON has been appointed acting director of operations for the Shipping Board to fill the vacancy recently made by the promotion of J. C. Jenkins to vice president of the Merchant Fleet Corporation.

RICHARD B. PEDERSEN has been made first assistant to Frank L. Jordan, chief engineer of the steamship *President Adams* of the Dollar Steamship Line, San Francisco, Cal., relieving P. J. Donahue who is on sick leave.

CAPTAIN JOHN M. EMERY, president of the Brighton Marine Repair Yard, Staten Island, New York, has been appointed by Mayor Walker director of the port, succeeding Joseph O'Brien, resigned. The post is an honorary one.

E. D. TENNEY, for the last 10 years president of the Matson Navigation Company, San Francisco, Cal., has been elected chairman of the board. William P. Roth, vice president and general manager, has been elected president. A. C. Diericx, assistant manager, has been appointed vice president.

Chief engineers for the Harvey H. Brown Great Lakes fleet of freighters have been announced as follows: Vessel, *H. H. Brown,* engineer, R. C. Cummings; *H. W. Croft,* engineer, W. J. McSweeney; *Fay Brown,* engineer, E. Harner; *Elton Hoyt II,* engineer, A. Butterworth; *M. A. Bardley,* engineer, A. Roberts.

MERRILL C. JOHNSON, after a short vacation ashore, has been made chief engineer of the steamship *Ecuador* operated by the Panama Mail Steamship Company, Inc., New York. James Smith, John W. Ahumada, Henry S. Perry and James M. Butler have been made first, second, third and licensed junior engineers respectively.

J. F. RAWLINSON, who has been assistant general superintendent of the Toledo Shipbuilding Company, Toledo, Ohio, for the last 9 years, has been appointed general superintendent of the company, succeeding W. D. Henderson, vice president and general superintendent, who has resigned. Prior to going to Toledo, Mr. Rawlinson was a surveyor for Lloyd's Register of Shipping.

CAPTAIN C. A. MCALLISTER, president of the American Bureau of Shipping, New York, sails for Paris on the *Leviathan* on June 11 to attend a conference to be held under the auspices of the Bureau Veritas on June 20 to form an international alliance of classification societies for the classification of commercial air craft. The alliance is to be composed of the national classification societies of Norway, Germany, France, Great Britain, Italy, Japan and the United States. Captain McAllister will be accompanied by Professor Alexander Klemin, aircraft expert of the Guggenheim Aeronautic Foundation, who is to act as consulting aeronautic engineer for the American Bureau of Shipping.

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H. B. WALKER, formerly president of the Old Dominion Line, has been elected president of the American Steamship Owners' Association, New York.

WALTER E. THAU, manager of marine engineering, general engineering department, Westinghouse Electric and Manufacturing Company, has been appointed director of marine engineering with headquarters in New York.

R. B. LEA has been appointed assistant sales manager of the Sperry Gyroscope Company, 40 Flatbush avenue, Brooklyn, N. Y. Mr. Lea will also continue as manager of the marine department. He became associated with the Sperry company immediately after leaving Cornell in 1915 and has had experience in nearly all departments of the company.

R. A. SHEERIN has been appointed general foreman of floating equipment of the Long Island Railroad Company, New York. Under the direction of the superintendent of motive power, Mr. Sheerin will have supervision of construction, damage surveys and repair of marine equipment. The position of engineer of floating equipment has been abolished.

M. J. WRIGHT, Pacific coast manager of the Luckenbach Steamship Company, Inc., with headquarters in San Francisco, Cal., has been appointed vice president of the company succeeding H. C. Cantelow, resigned. Zac T. George, Pacific coast traffic manager of the Luckenbach Company, succeeds Mr. Wright as Pacific coast manager. A successor to Mr. George has not been selected.

C. K. MCINTOSH, president of the Bank of California, San Francisco, has been elected a director of the American-Hawaiian Steamship Company, San Francisco, succeeding the late Henry Dearborn, vice president of the line. Roger D. Lapham was re-elected president and the other officers include J. D. Tomlinson of New York and John E. Cushing of San Francisco, vice presidents; W. J. Mahoney, San Francisco, secretary-treasurer. H. F. Howland was elected assistant treasurer at San Francisco.

J. LEWIS LUCKENBACH, formerly of the Luckenbach Line, has been elected executive vice president of the American Bureau of Shipping, New York, in charge of the classification of air craft. Mr. Luckenbach, who has been a member of the classification committee of the bureau, is well known in the steamship industry as an expert on ship construction as well as operation. During the World War he had charge of the construction of 35 ships built in Japan and 5 in China for the Shipping Board.

WILLIAM G. HENDERSON, vice president and general manager, Toledo Shipbuilding Company, Toledo, Ohio, resigned recently from this position after having been with the company for 22 years. Mr. Henderson has been connected with the shipbuilding industry for 42 years, the first twenty of which were with the Detroit Shipbuilding Company. During his Toledo service Mr. Henderson has superintended the construction of 82 vessels many of which are among the largest vessels on the lakes. He is also a director of the Security Savings Bank and Trust Company.

OBITUARY

CAPTAIN JAMES L. MYERS of the Great Lakes Towing Company died on May 7 at Detroit, Mich. Captain Myers was a member of the Licensed Tugmen's Protective Association and was well known in marine circles. He was 35 years of age.

HARRY G. DEERING died recently at his home in Bath, Maine. Mr. Deering was a member of the firm of Gardner G. Deering Company, builders of some of the famous schooners that once were regular traders along the coast.

HENRY BASSETT, aged 40, engineer of the United States mail boat *C. F. Bielman, Jr.*, which delivers mail to all freighters passing up and down the Detroit river, was scalded to death in the boiler room of the boat, May 7, in Detroit harbor. A broken gasket caused the accident.

KEY COMPTON, president of the Chesapeake Steamship Company of Baltimore, Md., died recently in the Union Memorial Hospital, Baltimore, following an operation. Mr. Compton had been president of the Chesapeake Line since October, 1909. He was in his 64th year.

AXEL ROSSELL of the firm of Rossell & Thayer, naval architects and marine engineers, Witherspoon Building, Philadelphia, Pa., died suddenly on May 23 from heart disease. Mr. Rossell was born at Kalmar, Sweden, on September 17, 1865, and was graduated from the University of Gothenberg in 1888. Soon after graduating he came to the United States and obtained a position with the William Cramp & Sons' Ship & Engine Building Company, Philadelphia, Pa., remaining with this firm for 7 years. Following this he was connected with the Maryland Steel Company, Sparrows Point, Md., returning to Cramp's shipyard in 1896 where a year later he was made head of the hull drafting department, a position which he held until the winter of 1918 when he was called to Washington to be assistant naval architect of the United States Shipping Board Emergency Fleet Corporation. Shortly after the war he traveled abroad as a special investigator for the Bethlehem Shipbuilding Corporation, Ltd. On returning to the United States he supervised the reconditioning of the *Leviathan* and the *Republic* and a number of other large passenger steamships. From this time until his death he maintained an office with Horace Holden Thayer in Philadelphia under the firm name of Rossell & Thayer, Naval Architects and Marine Engineers. Mr. Rossell had been a member of the Society of Naval Architects and Marine Engineers since 1895.

LOUIS C. BROOKS, electrical engineer of the Bethlehem Shipbuilding Corporation, Ltd., from 1918 to 1926, died recently at his home in Groton, Mass. Mr. Brook's life was devoted largely to electricity as applied to marine work. He was born at Brighton, Mich., on June 4, 1874. He graduated from Michigan State College in 1892 with the degree of B.S., and the degree of E.E. in 1908. Until 1899 he was associated with the General Electric Company, Schenectady, N. Y. Mr. Brooks entered the government employ in the superintending constructor's office at Newport News in connection with the construction of the battleships *Kearsage* and *Kentucky*, the first naval vessels to use the three-wire two-voltage system. He then temporarily left marine work for one year being with the Brown Hoisting Machinery Company, Cleveland, Ohio. When he returned to marine work at Cramp's shipyard in Philadelphia in 1902 it was in the government employ as expert electrical aide. From 1905 to 1910 he was master electrician at the Boston Navy Yard after which he again returned to the General Electric Company as commercial engineer, Industrial Control department. From 1918 to 1926 he was electrical engineer for the Bethlehem Shipbuilding Corporation, Ltd., at Bethlehem, Pa., and Quincy, Mass., from which he resigned, taking up work in the country where he hoped to regain his failing health. Mr. Brooks was chairman of the Committee on Applications to Marine Work, American Institute of Electrical Engineers for two years, 1924-1926; a member of that committee from 1918 to 1926; also a member of the committee on Meetings and Papers for one year.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Corporation Formed to Standardize Construction of New 10,000 Ton Scout Cruisers

INFORMATION has been received that a corporation has been formed by the shipyards which recently received contracts for the construction of the new 10,000-ton type scout cruisers, for the purpose of preparing plans and specifications for these ships. The private shipyards, which have organized the corporation are the Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa.; American Brown Boveri Electric Corporation, Camden, N. J., and the Newport News Shipbuilding and Drydock Company, Newport News, Va. The president of this corporation is John F. Metten, vice president of the American Brown Boveri Corporation, formerly chief engineer of the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa.

Under the recent awards of the six scout cruisers, the Bethlehem Shipbuilding Corporation will build scout cruiser *No. 26*, the American Brown Boveri Electric Corporation will construct cruiser *No. 27*, and the Newport News Shipbuilding and Drydock Company will construct cruisers *Nos. 30* and *31*. Cruiser *No. 28* will be built at the Puget Sound Navy Yard and *No. 29* will be built at the Navy Yard, Mare Island, California. In addition to these, the American Brown Boveri Electric Corporation at the same time was awarded a contract for scout cruiser *No. 25* (the *Salt Lake City*), and two sets of machinery for scout cruisers *Nos. 24* and *25*, which was formerly contracted for with the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa.

The stock of the new corporation will be owned by the interested companies which will have headquarters at either Camden, N. J., or Philadelphia, Pa.

In addition to preparing the working plans and specifications for the ships, in order that the construction may be based on exactly the same data in each case, the corporation will also prepare specifications for material and will probably conduct negotiations covering the material required, although no actual purchases will be made through its organization. The navy yards, in accordance with law, will be required to advertise and place contracts for material with the lowest responsible bidder.

The Navy Department itself is not actually involved in the organization except insofar as it will be required to handle departmental work dealing with design.

To Build Collier

PLANS and specifications are now in process of preparation for the construction of one or two colliers for the Berwind-White Coal Mine Company, 1 Broadway, New York City.

U. S. Coast Guard Issues Specifications for Construction of Five Turbo-Electric Cutters

SEALED proposals will be received by the United States Coast Guard, 14th and E Streets, N. W., Washington, D. C., until 2 P. M., June 21, and then publicly opened, for furnishing all labor and materials and performing all work for the construction and equipment of five Coast Guard cutters *Nos. 45, 46, 47, 48* and *49*. The general characteristics of the vessels are:

Length overall	250 feet
Beam, molded	42 feet
Displacement, 15 feet mean draft, about	2,075 tons
Turbo-electric drive, single screws: Shaft horsepower	3,000

Three vessels are to be completed on or before Oct. 31, 1928, and two on or before May 31, 1929. For the first three vessels Westinghouse propelling machinery and miscellaneous electrical equipment will be furnished by the government. For the last two vessels, contract for the machinery to be furnished by the government will not be awarded until after July 1, 1927. Bidders for the vessels must make a bid for each vessel provided Westinghouse machinery and miscellaneous electrical equipment is installed in all vessels and an alternative bid for each vessel provided Westinghouse machinery and equipment is installed in the first three vessels and machinery and equipment similar but of another manufacturer is installed in the last two vessels. For all five vessels the boilers, boiler room equipment and other auxiliaries will be similar.

For the first three vessels appropriations cover the total cost and the shipbuilder may build the vessels as rapidly as he desires. For the last two vessels appropriations cover a total expenditure of about $650,000 during the period July 1, 1927, to June 30, 1928, and the shipbuilder must arrange his building program for these two vessels to limit payment vouchers made within said period within that total sum.

Panama R. R. Co. Planning Replacement Program

IT is understood that the Panama Railroad Company, 24 State street, New York, under the management of T. H. Rossbottom, is studying the future possibilities for the service of the line and making tentative plans for replacement of ships and additions to the fleet. The entire matter is still in the formative stage, but it is expected that the outcome will eventually be the construction of new tonnage. No information is as yet available on the type to be built or the method of propulsion. It is expected, however, that in the next few months action will be taken in the matter.

Luckenbach Steamship Company May Build Two Express Freight Ships

PLANS and specifications for the construction of two express freight steamships of approximately 14,000 tons deadweight will soon be issued to shipyards for bids by the Luckenbach Steamship Company, Inc., 44 Whitehall street, New York, according to a report from reliable sources. The two liners are to be propelled by turbines driving twin screws and will represent the most advanced type of American freight carrier. Each will have a designed speed of more than 16 knots.

The propelling machinery will consist of geared turbines of about 7,000 horsepower. Each vessel will have two decks and all the modern appliances for rapidly handling general cargo. The winches will be steam driven and all cargo-handling gear will be considerably improved over the installation and equipment found on other vessels of the fleet. The vessels will have the same general characteristics as the *Andrea F. Luckenbach*, although a great many improvements in detail will be made.

It is understood that construction is to start in the late summer or early fall so that the vessels can be completed in about a year and enter the intercoastal trade between Philadelphia and other Atlantic ports and the Pacific Coast.

Plans and Specifications Completed for Chesapeake Line to Replace the City of Annapolis Recently Sunk

IT is understood that plans and specifications are about to be issued by the Chesapeake Steamship Company of Baltimore City, Baltimore, Maryland, for the construction of a steamer to replace the *City of Annapolis*, which was rammed and sunk by her sister ship, the *City of Richmond*, on February 24. The new vessel will in general follow the design of the *City of Annapolis*, but certain refinements which have been developed since the time of her construction will be incorporated.

The *City of Annapolis* was a steel vessel, having a length of 261.6 feet, beam of 53.1 feet and a depth of 14.1 feet, with a carrying capacity of 1,923 tons deadweight. She was built at the Sparrows Point plant of the Bethlehem Shipbuilding Corporation, Ltd., in 1913. The *City of Annapolis* was equipped with a four-cylinder triple expansion reciprocating engine, having cylinder diameters of 23 inches, 38 inches, 45 inches and 45 inches, with a stroke of 36 inches, developing 2,300 indicated horsepower. Steam was supplied by four Scotch boilers, at a working pressure of 190 pounds per square inch.

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Bids Received May 24 for 60-Foot Side Wheel Tug

SEALED proposals were received by the United States Engineer Office, Milwaukee, Wis., until May 24, and then opened, for the construction of one 60-foot steel side-wheel tug. The general description of the tug is as follows:

Length, overall	61 feet ¼ inch
Length, molded	60 feet
Breadth, molded	20 feet
Breadth, main deck at side, molded	30 ft. 4 in.
Breadth, overall	31 feet 10 inches
Depth at side, molded	5 feet 4 inches
Depth at center line, molded	5 feet 6¼ inches
Sheer forward, molded	1 foot 11 inches
Sheer aft, molded	1 foot 2 inches
Camber, straight taper, in 15 feet 2 inches	4 in.
Draft, as specified	3 feet 6 inches

The transeverse system of framing is to be used .

The contractor is to furnish and install for operation of the paddle wheels two 4-cylinder, vertical, two-cycle, single acting, heavy duty, direct reversible marine type oil engines, capable of operating on fuel oils of 24 degrees Baumé gravity. Each engine is to develop 70 brake horsepower when operating at not more than 400 revolutions per minute.

A steam steering engine with cylinders of 4-inch bore and 4-inch stroke is to be furnished and installed in the pilot house. The engine is to be arranged so that it can be quickly changed from steam to hand power, equivalent to the type and quality of the "Beck No. 4" manufactured by the Manitowoc Shipbuilding Corporation, Manitowoc, Wis.

Other equipment to be installed includes: One hand rotary force pump, with flywheel, made by the Deming Company, Salem, Ohio, or equal, to be furnished and installed in a convenient space for pumping fuel oil from the two fuel oil tanks in hold to the fuel oil service tanks, to have a capacity of 5½ gallons per minute when operated at 50 revolutions per minute; a horizontal, duplex, fire and bilge pump, 5¼ inches by 3½ inches by 5 inches; a vertical firetube boiler of approved design, approximately 39 inches in diameter and 85 inches in height, of sufficient capacity for developing 20 horsepower at 130 pounds steam pressure, to be designed and constructed to meet the requirements of the United States Steamboat Inspection Service; a suitable air compressor mounted and driven by each engine for furnishing starting air and maneuvering air; a steam-driven gypsy capstan of approved design, with 14-inch barrel and 4-inch by 6-inch double cylinder engine, similar to the type and quality manufactured by the American Engineering Company, Philadelphia, Pa., or equal, etc.

Further information may be obtained on application.

Dravo Company to Build Six Oil Barges for South America

A CONTRACT for the construction of six steel oil barges for South America, and for operation on the Magdalena river trade, has been awarded to the Dravo Contracting Company, Neville Island, Pittsburgh, Pa., by the International Petroleum Company, Ltd., Toronto, Canada. The barges are each to be 100 feet long, 30 feet wide and 6 feet 6 inches deep and will be equipped with pipe lines and pumps. The price involved was not given out.

Contract About to Be Placed with Bethlehem Corp. for Converting the West Gramma to Diesel Drive

A CONTRACT is about to be placed with the Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., for the installation work in connection with converting the *West Gramma* to Diesel engine drive. This contract has been pending for some weeks until the 30-day test on the McIntosh and Seymour double acting engine, which is to be installed, had been completed. The contract is based on a set of revised specifications which have been issued to the Bethlehem Shipbuilding Corporation, the same procedure being followed as in the case of the *Yomachichi,* which was awarded to the Newport News Shipbuilding and Drydock Company, Newport News, Va., and the *Seminole* which was awarded a short time ago to the Todd Shipyards Corporation, New York.

Bids Received for Reboilering Savannah Line Vessels

BIDS were received Thursday, May 19, by the Ocean Steamship Company of Savannah, Savannah, Ga., for the fitting of new boilers in the steamships *City of Columbus* and *City of Atlanta.* The vessels were each originally fitted with four Scotch boilers, carrying a working pressure of 180 pounds per square inch. The present bids included the replacement of the old boilers with either four or three new boilers of the same total power. The work will also include a general overhaul of machinery.

Bids Being Received for Diesel Yacht

IT is understood that the firm of Henry J. Gielow, Inc., 25 West 43rd street, New York City, is now asking bids for the construction of a Diesel yacht, which will have a length of about 260 feet. At the time of going to press it could not be learned for whom the yacht was to be built nor the detailed characteristics of the vessel. Additional information will undoubtedly be available shortly.

City of Portland, Oregon, Awards Contract for Fireboats

A CONTRACT for the construction of three new steel fireboats has been awarded to the Baker Construction Company, Portland, Oregon, by C. E. Bigelow, Commissioner of Public Affairs, Portland, at a price of $150,711. The boats are to be either Diesel or gasoline driven. Bids were received and opened at Portland on May 5.

Five other proposals were received for this work from other firms ranging from $152,000 to $177,227.

Construction of New River Barges Planned

The Wheeling Steel Corporation of Wheeling, West Virginia, is working out a program for the construction of new barges for use on the Ohio river. Further details will be available shortly.

Plans for Reconditioning Liners Mount Vernon and Agamemnon in Hands of Shipping Board Committee

CHAIRMAN O'CONNOR of the Shipping Board has appointed Commissioners Edward C. Plummer, William S. Benson and Jefferson Myers as a committee to consider the merits of the three different plans for reconditioning the liners *Mount Vernon* and *Agamemnon* as submitted by General A. C. Dalton of the Merchant Fleet Corporation to the board.

The plans provide for putting either ship in shape by utilizing the present engines and boilers and using coal, at a cost of approximately $2,500,000. To use the present engines and boilers and change to oil burners, the cost would be $3,000,000. To remove the present equipment and install turbines, the cost would be in the neighborhood of $6,000,000 for each ship.

It is understood that funds now available would not meet the cost of reconditioning and reports have been received that the Shipping Board would probably defer action on reconditioning the two vessels until Congress meets in December.

Bids Asked for Two Steel Deck Scows

SEALED proposals were received by the War Department, United States Engineer Office, Philadelphia, Pa., until 12 o'clock noon, Eastern Standard Time, May 25, 1927, and then publicly opened, for furnishing all labor and materials and performing all work for constructing and delivering two 102-foot steel deck scows.

The general dimensions of the scows are as follows: length, molded, 102 feet; width, molded, 30 feet; depth at side, molded, 10 feet, and depth at center, molded 10 feet 4 inches. The scows are to have curved rakes, transverse watertight bulkheads on frames 1 and 40 and three longitudinal trusses.

Unless otherwise specified all work is to be in accordance with the appropriate current Rules of the American Bureau of Shipping, where applicable.

Dravo Contracting Company to Build Three Maneuver Boats

A CONTRACT for furnishing all labor and materials and performing all work for three steel maneuver boats has been awarded to the Dravo Contracting Company, Pittsburgh, by the United States Engineer Office, Pittsburgh, Pa., at a price of $66,150, bids for which were received at Pittsburgh on April 27. The boats are to have a molded length of 60 feet, molded beam of 22 feet and a molded depth of 4 feet.

Canadian Railways Plans Construction of Five Ships

Information has been received that the Canadian National Railways will receive proposals from British and Canadian shipbuilders until June 15, for the construction of the five ships to be operated with the improved West Indies service. There is no definite idea as to what part of the building program will be carried on in Canada but it is understood that some of it will be. The ships will require about a year for construction.

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Winchester Company Retains American Merchant Lines

INFORMATION has been received that the United States Shipping Board has rejected the recommendation of General A. C. Dalton, president of the Merchant Fleet Corporation, to merge the passenger service of the American Merchant Lines with the United States Lines and to allocate the freighters operated by J. H. Winchester and Company to the South Gate Marine Corporation of Norfolk. It is understood that the Winchester Company will be retained as operating agents of the American Merchant Lines.

General Dalton announced last month that if the board did not approve his recommendation he would favor the retention of the Winchester Company as operating agent of the 10 ships involved.

Shipping Board Honor Roll for the Last Six Months of 1926

THE Fuel Conservation Committee of the United States Shipping Board Merchant Fleet Corporation announces the adoption of their Honor Roll of Chief Engineers and Masters of the 50 best performing vessels in the Shipping Board Fleet for the six months period, July 1, 1926, to December 31, 1926. This is the fifth semi-anual Honor Roll published by the committee. This roll was established as a means of stimulating competition among the various Shipping Board vessels, with the view to improving the economy of their performance. The mentioning of a Chief Engineer and Master on this Honor Roll entitles each one to a bonus of $50 in recognition of their efforts in establishing a sufficiently high record to warrant placing the ship in this banner class.

The Honor Roll is limited to the 50 best performing vessels and as there were so many vessels showing good performances, that fell just a little short of making the Honor Roll, there has also been adopted an Honorable Mention Roll consisting of 47 vessels. This Honorable Mention Roll does not entitle the Chief Engineer and Master to the $50 bonus.

A high standard of efficiency has been set to entitle a vessel to be listed on the Honor Roll. It must have traveled at least 20,000 miles during the period covered and must have maintained a port and sea efficiency rating which is equal to 95 percent of that of the best performer in the particular class or type of vessel in which the vessel falls. Particular attention is paid to maintenance of the vessel, embracing repair costs, physical condition, cleanliness, etc., throughout.

On the Honor Roll there are 16 vessels that make the grade for the first time; 15 vessels have been listed once before; 12 have secured mention twice; 4 three times and 3 who have been selected four times. Of the chief engineers appearing on this Honor Roll, 26 show for the first time, eight for the second time, 7 for the third time, 5 for the fourth time, and 4 for the fifth time.

In compiling this Honor Roll, a study has been made of the performance of 299 vessels for which complete records were available. During the period of the Roll, these vessels have traveled a total distance of 6,812,051 miles. It is gratifying to note that the fuel performance of these vessels not only shows a continuance of the record that they have consistently established since the establishment of the Fuel Conservation Committee, but also show a total saving in oil consumption amounting to $233,250, and in coal consumption a saving of $50,343, or a total saving of $283,593, as compared to the previous six months period. Through the means of stimulatnig efficiency and interest throughout the operating forces on the vessels, the Fuel Conservation Committee is pleased to report that there has been an annual saving in the fuel consumption of approximately $3,000,000 per year, as compared with the fuel performance prior to 1922.

This remarkable saving could not have been accomplished without the earnest and conscientious efforts of the vessels' personnel and the port staff of the operating companys in adopting and utilizing to such a large extent the standard methods of operation promulgated from time to time by the Fuel Conservation Committee.

Honor Roll

*Period July 1, 1926, to December 31, 1926**

America France Line—S. S. *Collamer*, E. L. Davison, chief engineer; M. T. Valeur, master. S. S. *Waukegan* (3), E. Hamilton, chief engineer; Clifton Smith, master.

American Australia Orient Line—S. S. *West Calera* (2), H. George, (3) chief engineer; H. Hanson, master. S. S. *West Nivaria*, R. E. George, chief engineer; E. H. Phillips, master.

American Diamond Lines—S. S. *Wytheville* (1), J. A. Bruno, chief engineer; R. H. Webb, master.

American Dixie Line—S. S. *Wauna* (1), J. T. Flannery, chief engineer; J. C. Wenzel, master. S. S. *Duquesne* (1), L. V. Le Beuf (1), chief engineer; G. D. Tipton, master. S. S. *Colorado Springs* (4), N. Hendricksen (4), chief engineer; H. O. Weatherbee, master. S. S. *West Ekonk* (1), T. Sheridan (4), chief engineer; H. Simmons, master.

American India Line—S. S. *Arcturus* (1), J. Goette, chief engineer; C. Olsen, master. S. S. *Egremont*, J. Turpin, chief engineer; D. Holt, master.

American Merchant Lines—S. S. *American Farmer* (1), H Comstock (1), chief engineer; H. S. Myddleton, master. S. S. *Lehigh* (2), S. J. Miller (2), chief engineer; C. F. Peterson, master.

American Oriental Mail Line—S. S. *Wheatland Montana*, J. H. Benson, chief engineer; T. Morton, master.

American Pioneer Line—D. D. *Dryden* (3), J. McKerral (3), chief engineer; C. T. Kight, master. S. S. *Independence* (1), J. Stadwicke, chief engineer; J. L. Jones, master. S. S. *Ethan Allen* (1), E. H. Knee (1), chief engineer; A. C. Iverson, master. S. S. *Liberator*, N. Johnson, chief engineer; G. D. Smith, master. S. S. *William Penn* (2), O. Staff, engineer; R. H. Wright, master.

American Premier Line—S. S. *Jolee* (1), E. Tillotson, chief engineer; H. Muller, master. S. S. *Quistconck* (1), C. B. Brown (1), chief engineer; G. Olofson, master. S. S. *Carlton* (2), R. Leach (2), chief engineer; M. Lyras, master.

American Republics Line—S. S. *The Angeles*, chief engineer; H. Peterson, master. S. S. *Culberson* (2), S. O. Clare, chief engineer; W. H. Harstedt, master.

American West African Line—S. S. *Otho*, G. Van Hoesen, chief engineer; M. E. Huntley, master.

Atlantic Australian Line—S. S. *Easterner* (1), W. Gallagher, chief engineer; J. D. Schofield, master.

Gulf West Mediterranean Line—S. S. *Jomar* (1), C. Pepper, chief engineer; D. E. Griffin, master. S. S. *Cardonia* (2), J. L. Dalton (2), chief engineer; W. B. Zichel, master. S. S. *O'Gontz* (2), B. Van Hein (2), chief engineer; B. J. Cheshire, master. S. S. *West Chetac*, J. B. Peel, chief engineer; J. M. Dunn, master.

McAllister Bros.—S. S. *Baldhill* (2), P. Donovan (2), chief engineer; J. D. Lydon, master.

Mississinni Valley European Line—S. S. *Carplaka*, A. Isaacson, chief engineer; H. P. Smith, master. S. S. *Cranford*, P. J. Battam, chief engineer; G. H. Steel, master.

Mobile Oceanic Line—S. S. *West Hardaway* (3), J. Sherlock (3), chief engineer; John Simmons, master. S. S. *West Hika* (1), C. P. Hill, chief engineer; R. N. Sweeting, master. S. S. *Effingham* (2), W. P. Jones (2), chief engineer; G. S. Hancock, master. S. S. *Antinous* (3), M. Briesten (3), chief engineer; D. S. Stewart, master.

*Figures in parentheses indicate the number of previous honor rolls on which the vessel or chief engineer as the case may be has been listed.

Oriole Lines—S. S. *Winona County*, P. H. Rankin, chief engineer; R. B. Atherton, master. S. S. *Kerhonkson*, E. Orne, chief engineer; S. Broadwick, master.

Southern States Lines—S. S. *Cliffwood* (2), I. Birks, chief engineer; M. A. Rowe, master. S. S. *Chester Valley*, W. R. Jones, chief engineer; C. T. McMains, master. S. S. *West Camak* (1), N. Gaston (1), chief engineer; D. R. Williams, master. S. S. *Westmoreland*, P. Thompson, chief engineer; W. Atkinson, master. S. S. *Effna*, A. Rosamond, chief engineer; H. S. Olsen, master. S. S. *Bayou Chico* (2), B. Trachenburg (2), chief engineer; R. Armstrong, master.

United States Lines—S. S. *President Roosevelt* (2), J. Turner (3), chief engineer; Geo. Fried, master. S. S. *Leviathan* (4), J. J. Fagan (4), chief engineer; H. Hartley, master. S. S. *George Washington* (4), W. G. Grace (4), chief engineer; H. Cunningham, master. S. S. *Republic* (1), A. W. Styron (1), chief engineer; A. B. Randall, master.

Honorable Mention

America France Line—S. S. *Independence Hall*, J. W. Hall, chief engineer; W. M. Hart, master. S. S. *McKeesport*, R. L. Beaird, chief engineer; E. S. Fayle, master. S. S. *Vincent*, J. B. Sisson, chief engineer; Alex Smart, master. S. S. *Liberty*, P. G. Lockhart, chief engineer; L. J. Nordskog, master.

American Australia Orient Line—S. S. *West Carmona*, E. Myers, chief engineer: L. Drewson, master. S. S. *West Conob*, C. A. Sjolund, chief engineer; John Reek, master.

American Diamond Lines—S. S. *Tomalva*, A. Andrews, chief engineer; G. W. Jensson, master. S. S. *Western Ally*, G. Poortvliet, chief engineer; E. W. Carver, master.

American Dixie Line—S. S. *Mount Evans*, R. Campbell, chief engineer; J. M. Wightwick, master. S. S. *West Hobomac*, C. B. Yule, chief engineer; C. H. Hewlett, master. S. S. *West Modus*, J. R. Cotie, chief engineer; E. M. Roupe, master.

American India Line—S. S. *Algic*, G. Gustavson, chief engineer; A. Ricca, master.

American Merchant Lines—S. S. *American Trader*, C. Anderson, chief engineer; H. Fish, master. S. S. *Quaker City*, F. C. Stewart, chief engineer; S. S. Connauton, master.

American Oriental Mail Line—S. S. *Cuprum*, J. W. Groesch, chief engineer; Alex. Stinson, master.

American Pioneer Line—S. S. *Oakpark*, C. Cumming, chief engineer; T. C. Selness, master. S. S. *Archer*, E. H. Williams, chief engineer; B. E. Hanson, master.

American Republics Line—S. S. *St. Anthony*, H. P. Saxe, chief engineer; C. B. Delaney, master.

Atlantic Australian Line—S. S. *Eastern Planet*, W. Richards, chief engineer; R. Rose, master.

Gulf Brazil River Plate Line—S. S. *Lorraine Cross*, E. J. Russell, chief engineer; W. H. Hugett, master.

Gulf West Mediterranean Line—S. S. *Prusa*, C. Davidson, chief engineer; J. D. Mason, master. S. S. *West Chatala*, S. T. Pritchett, chief engineer; I. M. Holt, master.

Mississippi Valley European Line—S. S. *West Erral*, H. Hammeros, chief engineer; A. W. Jamison, master.

Mobile Oceanic Line—S. S. *Maiden Creek*, P. Calagez, chief engineer; E. L. Wheadon, master. S. S. *Saco*, J. Culliton, chief engineer; A. R. Lyngby, master. S. S. *Afoundria*, J. L. Jones, chief engineer; R. L. Hooper, master. S. S. *Coahoma County*, A. E. Miller, chief engineer; C. Reed, master. S. S. *Federal*, J. Churchill, chief engineer; J. O. Seiber, master. S. S. *Hastings*, R. Lemon, chief engineer; O. Hystad, master.

Oregon Oriental Line—S. S. *West Cadron*, J. L. Braun, chief engineer; C. J. Swenson, master. S. S. *West Holbrook*, R. Willis, chief engineer; O. W. Carlson, master. S. S. *West O'Rowa*, J. P. Beeler, chief engineer; S. P. Wendt, master. S. S. *Oakridge*, P. Harreschou, chief engineer; A. Johnson, master.

Oriole Lines—S. S. *Bellhaven*, J. W. Calmes, chief engineer; J. L. Martino, master. S. S. *Clairton*, J. Sylvester, chief engineer; J. M. Dunn, master. S. S. *Bannack*, H. E. Jordan, chief engineer; G. W. McCormack, master.

Southern States Lines—S. S. *Cody*, E. S. Rassmussen, chief engineer; E. J. Madden, master. S. S. *Sapinero*, J. Wenholt, chief engineer; F. Ward, master. S. S. *Aquarius*, F. Frederickson, chief engineer; W. H. Stone, master. S. S. *Oakwood*, C. Walters, chief engineer; H. Ward, master.

Texas Star Line—S. S. *Conness Peak*, T. Jerrett, chief engineer; G. P. Townsend, master. S. S. *Saguache*, C. J. Spatz, chief engineer; E. Simpson, master. S. S. *Endicott*, R. Hendrickson, chief engineer; W. Henderson, master. S. S. *Emergency Aid*, E. Jurkowski, chief engineer; M. Cameron, master.

United States Lines—S. S. *President Harding*, J. W. Rakow, chief engineer; T. O. Van Beek, master.

Yankee Line—S. S. *Westpool*, R. Phinney, chief engineer; L. F. Thompson, master. S. S. *Scattle Spirit*, E. H. Draner, chief engineer; G. V. Hedman, master.

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Cities Service Corp. Places Order with Bethlehem Corp. for Oil Barge

A CONTRACT has been placed by the Cities Service Corporation, New York, with the Bethlehem Shipbuilding Corporation, Ltd., (Bethlehem, Pa.) for the construction of a 7,000-barrel oil barge. The barge will be built at the Fore River plant of the Bethlehem Corporation, Quincy, Mass. This barge, which is of the scow type, has a length of 150 feet.

Todd Seattle Yard to Recondition the Steamship Comfort

THE steamship *Comfort,* formerly the Ward liner *Havana,* which was recently purchased by the Atlantic, Gulf and West Indies Steamship Lines on the Pacific Coast, where she had been laid up for some time, is to be reconditioned by Todd Dry Docks, Inc., Seattle, Wash., and will probably be added to the Mallory Line service. The plans and specifications for this work were prepared by Theodore E. Ferris, naval architect, 30 Church street, New York.

Pennsylvania Carfloats Awarded

IT is unofficially reported that contracts for the construction of eight carfloats of various sizes for the Pennsylvania Railroad, bids for which were received last month, have been awarded as follows:

Four 250-foot floats to the Federal Shipbuilding Company, Kearny, New Jersey.

Two 330-foot floats to the Sun Shipbuilding and Drydock Co., Chester, Pa.

Two 185-foot floats to the American Brown Boveri Electric Corp., Camden, N. J.

Shipping Board to Scrap Tonnage Unfit for Service

REPORTS have been received that an extensive survey had been begun by the Merchant Fleet Corporation of the Shipping Board's laid-up fleet of more than 500 vessels with the object in view of scrapping about 300. Those found worthless will be segregated and bids asked for their breaking up.

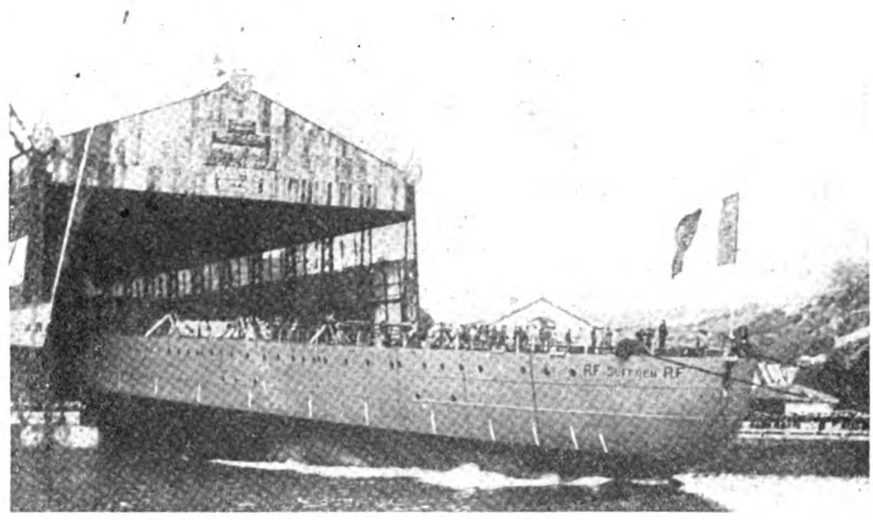
The ships in question were hastily constructed during the war for the purpose of getting them in service as quickly as possible. They are anchored in different sections of the country, including the Hudson, Staten Island, James river, New Orleans, Mobile, San Francisco and Seattle.

Damage to U. S. S. Colorado

The battleship *Colorado,* which was grounded in the North River, has been towed to the Navy Yard, Brooklyn, New York. The grounding of the vessel has cost the navy $75,000, exclusive of repairs, which will be extensive because two of the ship's plates were twisted and a part of the keel stripped.

Keel Laid for Submarine V-5

The keel of the latest submarine for the United States naval service was laid at the Navy Yard at Portsmouth, N. H., at noon on Tuesday, May 10.



(Photograph from Keystone View Co., Inc., of N. Y.)

Launching at Brest, France, of the 10,000-ton, 34-knot cruiser Suffren, sister ship of the Duquesne and the Tourville

American Welding Society Announces Establishment of the Miller Medal

AT the annual dinner of the American Welding Society held in New York on April 28, President F. M. Farmer announced the donation of an award, the gift of Samuel Wylie Miller, to be presented by the society annually in appreciation of work of outstanding merit in advancing the art and science of welding. The award is a gold medal, which will be known as the Miller Medal.

S. W. Miller

Mr. S. W. Miller has been one of the outstanding figures in the advancement of welding ever since its commercial inception. He is a past president of the American Welding Society, and a prominent and active member of the Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers and other scientific and engineering organizations. He has been long noted for his energetic insistence upon high quality and dependable workmanship and upon the development of welding by all processes along lines scientifically well founded. Mr. Miller is consulting engineer, Union Carbide and Carbon Research Laboratories, Inc.

In establishing this award, the details for the administration of which are not yet decided upon, Mr. Miller's object is to promote an appreciation of better welding and to encourage the study of those fundamentals which will lead to raising the quality of work done by the average operator.

In accepting the administration of this award on behalf of the American Welding Society, Mr. Farmer outlined briefly the history and ideals of its donor, and expressed himself as being particularly gratified that during his administration the Welding Society should be granted the privilege of managing such an important contribution to the improvement of the welding industry.

Morse Drydock to Repair S.S. Suevier

THE Morse Drydock and Repair Company, Brooklyn, N. Y., was successful bidder for repairs to the Lloyd Royal Belge Line steamship *Suevier,* bids for which were opened in New York on Tuesday, May 3, as follows:

Name	Price	Days
Morse Drydock and Repair Company	$6,358	17
Robins Drydock and Repair Company	6,660	18
Staten Island Shipbuilding Company	9,645	32
Theodore A. Crane's Sons Company	7,218	18

Bids for Patrol Boat Asked

SEALED proposals will be received by the Superintendent of Lighthouses, Third District, Staten Island, New York, until June 7, and then opened, for the construction of a 50-foot patrol boat. The general characteristics of the boat are: Length from forward side of stem to aft side of stern board, 50 feet; beam, to outside of plank, 10 feet; depth from top of keel to top of beam at side, 5 feet 6 inches; camber of beam in 10 feet, 3 inches.

The boat is to be equipped with a six-cylinder, four-cycle gasoline engine, operating at 800 revolutions per minute and capable of delivering not less than 85 brake-horsepower. A double-acting force pump, having cylinder diameters of 3 inches with a stroke of 4½ inches, is also to be installed. Further information may be obtained on applications.

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Ship Construction and Repair Bids

Hanlon Dry Dock Low Bidder for West Tagus Repairs

WITH a price of $23,821, the Hanlon Drydock and Shipbuilding Company, Oakland, California, was low bidder for reconditioning the steamship *West Tagus* to put the vessel into condition for spot service. Bids for the work were received recently by the Shipping Board on the West Coast.

Bids for Southern Pacific Steamer El Lago

BIDS were received at New York, on Monday, April 25, by the Southern Pacific Steamship Lines, covering repairs to the steamship *El Lago*, with the following results:

Name	Price
W. & A. Fletcher Company	$29,600
Robins Drydock and Repair Company	32,718
Tietjen & Lang Drydock Company	33,625
James Shewan & Sons, Inc.	36,212
Morse Drydock and Repair Company	41,295

Repair Bids for Government Dredge and Three Barges

TENDERS were received at New York on Monday, May 9, by the War Department, covering repairs to the dredge *Hellgate* and dump scows *Nos. 20, 21, 22*, with the following results:

Name	Price	Days
Todd Shipyards Corporation	$10,371	15
W. & A. Fletcher Company	10,610	11
Morse Drydock and Repair Company	10,876	15
Robins Drydock and Repair Company	10,980	15
Staten Island Shipbuilding Company	11,175	10
John W. Sullivan	14,547	28
Ira S. Bushey & Sons, Inc.	14,600	18

Several prices were submitted on a number of miscellaneous items which were not figured in the totals.

Bids for Pennsylvania Carfloats

THE tenders received and opened on Friday, April 22, at the marine department of the Pennsylvania Railroad, Philadelphia, Pa., for the construction of eight carfloats of various sizes are as follows:

Name	Group One—(250-foot floats)				Group Two—(330-foot floats)		Group Three—(185 foot floats)	
Item No.	1	2	3	4	1	2	1	2
American Brown	$70,400 (7½ mo.)	$68,900 (7½ mo.)	$68,400 (8 mo.)	$68,125 (8 mo.)	$98,100 (5½ mo.)	$96,000 (6 mo.)	$54,000 (6½ mo.)	$51,500 (7 mo.)
Federal	73,000 (6 mo.)	70,000 (7 mo.)	68,000 (8 mo.)	68,000 (9 mo.)	97,000	94,000	57,000	55,000 .....
Sun Shipbuilding	76,000 (6½ mo.)	151,000 (7 mo.)	225,500 (7½ mo.)	299,500 (8 mo.)	94,000 (8 mo.)	186,000 (8½ mo.)	62,650 (9 mo.)	124,150 (9½ mo.)
Staten Island	83,500 (24 wks.)	81,580 (31 wks.)	80,940 (32 wks.)	80,600 (36 wks.)	(No. Bid)		62,390 (15 wks.)	60,650 (18 wks.)
Todd	125,074	120,448	118,906	118,135	(No. Bid)		91,577	90,480
Newport News	No Bid)	(First in 6 months—Balance in 12 months)			(No Bid)	107,750	(No. Bid)	
Bethlehem	81,300 (5½ mo.)	158,600 (5½ to 6 mo.)	236,000 (5½-6-6½ mo.)	312,800 (5½-6-6½-7 mo.)	(Each 6½ mo.) 109,000 (6 mo.)	215,500 (6-7 mo.)	64,000 (5½ mo.)	125,100 (6 mo.)

The Bethlehem Shipbuilding Corporation, Ltd., submitted a combination bid as follows:

Eight floats	$638,000	5½ to 8 months
Two 330-foot floats and two 185-foot floats	336,000	5½ to 7 months
Four 250-foot floats and two 330-foot floats	522,000	5½ and 7½ months
Four 250-foot floats and two 185-foot floats	435,500	5½ and 7 months

Morse Drydock Repairs S.S. Liberator

A CONTRACT for general repairs to the steamship *Liberator* has been awarded to the Morse Drydock and Repair Company, Brooklyn, New York, by the United States Shipping Board, at a price of $13,730, bids for which were received recently in New York. Other tenders received were as follows:

W. & A. Fletcher Company	$14,000
New York Harbor Drydock Company, Inc.	14,950
James Shewan & Sons, Inc.	16,317
Theodore A. Crane's Sons Company	17,006
Todd Shipyards Corporation	17,200

Merrill-Stevens Company Repairs S.S. Waalhaven

A CONTRACT for repairs to the Dutch steamship *Waalhaven* has been awarded to the Merrill-Stevens Drydock and Repair Company, Jacksonville, Fla., at a price of approximately $20,000. The steamer was badly damaged in an ice floe off New Foundland and put into Boston in distress. Cement packs were used to enable the vessel to proceed to Jacksonville to discharge the remainder of her undamaged cargo. About 20 steel plates will have to be replaced.

Sullivan Yard Awarded Contract for Repairs to Carfloat

THE John W. Sullivan Shipyard, 827 E. Ninth street, New York City, has been awarded a contract for general repairs to the New York, New Haven and Hartford Railroad Company's carfloat *No. 2*, at a price of $11,567 and 18 days' time. Eight other proposals were received for the work as follows:

Name	Price	Days
James Tregarthen & Sons Company, Inc.	$13,475	30
Ira S. Bushey & Sons, Inc.	14,000	22
Morse Drydock and Repair Company	14,457	30
Staten Island Shipbuilding Company	17,220	32
James Shewan & Sons, Inc.	17,494	24
Tietjen & Lang Drydock Company	19,415	29
Todd Shipyards Corporation	20,900	35
Theodore A. Crane's Sons Company	21,000	30

Carfloat Repair Bids Submitted

BIDS were recently received at New York covering repairs to the New York, New Haven and Hartford Railroad carfloat *No. 63*, with the following results:

Name	Price
James Shewan & Sons, Inc.	$7,200
Staten Island Shipbuilding Company	7,925
Theodore A. Crane's Sons Company	8,000
Todd Shipyards Corporation	8,350
John W. Sullivan	8,465
Tietjen & Lang Drydock Company	8,467
Morse Drydock and Repair Company	8,595

The award has not as yet been made. Several prices were also received covering a number of miscellaneous items which were not figured in the totals.

Crane Repairs the Mallory Steamer Ansonia

THE Theodore A. Crane's Sons Company, 25 Broadway, New York City, has been awarded the contract for repairs to the C. D. Mallory and Company steamship *Ansonia*, at a price of $11,980 and 14 days' time, bids for which were received at New York on Wednesday, May 4. Other tenders received for the work include the following:

Name	Price	Days
Tietjen & Lang Drydock Company	$12,350	17
Staten Island Shipbuilding Company	12,500	15
Morse Drydock and Repair Company	18,875	15

U. S. Engineers Receive Bids for Three Maneuver Boats

TENDERS were received and opened by the United States Engineer, War Department, Pittsburgh, Pa., on Wednesday, April 27, for furnishing all labor and materials and performing all work for furnishing and delivering three steel maneuver boats. The boats are to have a molded length of 60 feet, molded beam of 22 feet and a molded depth of 4 feet. The bids received were as follows:

Name	Price
Dravo Contracting Company	$66,150
Charles Ward Engineering Works	74,900
Midland Barge Company	79,200
Charles Hegewald Company	128,900
Howard Shipyards and Dock Company	159,973

Fletcher Yard Overhauls S.S. W. E. Hutton

THE W. and A. Fletcher Company, Hoboken, N. J., has received the contract for general overhaul to the steamship *W. E. Hutton*, at a price of $10,600 and 8 days' time. Bids for the work were received by F. S. Martin and Son, 25 Broadway, New York, on Monday, May 9. Other tenders submitted include:

Name	Price	Days
New York Harbor Drydock Company	$11,850	8
Staten Island Steamship Company	12,042	7
Sun Shipbuilding and Drydock Company	13,608	8
Tietjen & Lang Drydock Company	14,641	8
Morse Drydock and Repair Company	14,854	7
Todd Drydock, Engineering and Repair Corp.	14,916	8
Robins Drydock and Repair Company	14,925	8
Theodore A. Crane's Sons Company	15,500	12
James Shewan & Sons, Inc.	16,994	10
Bethlehem Shipbuilding Corporation, Ltd.	24,361	14

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General Repairs Required to Steamship Mirbo

TENDERS were received and opened at the office of Captain S. C. Halvorsen, 25 Beaver street, New York, on Tuesday, May 17, covering repairs to the steamship *Mirbo*, with the following results:

Name	Price	Days
Morse Drydock and Repair Company	$16,883	10
Robins Drydock and Repair Company	19,650	14
Tietjen & Lang Drydock Company.	19,664	15
Staten Island Shipbuilding Company	19,926	14
James Shewan & Sons, Inc.....	22,700	15

The award has not as yet been made.

Bids for Work on S.S. Momus

THE Southern Pacific Steamship Lines, New York, received bids on Monday, May 16, for repairs to the steamship *Momus*. Four tenders were received as follows:

Name	Price	Days
Morse Drydock and Repair Company	$17,400	30
W. & A. Fletcher Company.....	17,790	21
Robins Drydock and Repair Company	19,750	18
Tietjen & Lang Drydock Company.	21,445	20

In each case about 14 weeks, more or less, will be rqeuired to complete castings. The time given for the work would be necessary after the castings were received.

Bethlehem to Convert Tanker Tuxpanoil to Diesel Drive

TENDERS were received and opened at the office of Charles E. Ross, naval architect, 16 Exchange place, New York, on Tuesday, May 3, covering the conversion of the tanker *Tuxpanoil* to Diesel drive. The *Tuxpanoil* was purchased April 22, 1926, by the Oil Transport Company of Baltimore, Maryland, from the Merchant Fleet Corporation. The bids received were:

Name	Price	Days*	Collision damage
Morse Drydock and Repair Company	$179,856	120	$1,285
Bethlehem Shipbuilding Corporation, Ltd.	185,840	110	850
Staten Island Shipbuilding Company	210,000	140	1,000
Newport News Shipbuilding and Drydock Co	215,000	150	880
Robins Drydock and Repair Company	286,300	120	1,940

*Demurrage, $300 per day.

The contract was awarded to the Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa.

Bids Received for Repairs to S.S. Dirigo

WITH a price of $14,900 and 9 days' time, the W. and A. Fletcher Company, Hoboken, New Jersey, submitted the lowest figure for repairs to the steamship *Dirigo* of the Texas Company, 17 Battery place, New York, bids for which were recently opened. Other tenders received for the work include:

Name	Price	Days
New York Harbor Drydock Company, Inc.	$16,568	14
Robins Drydock and Repair Company	16,850	9
Staten Island Shipbuilding Company	17,956	9
Morse Drydock and Repair Company	21,195	10

Separate prices were also submitted on a number of miscellaneous items which were not figured in the totals.

Standard Oil Co. of N. J. Awards Work on M. S. E. T. Bedford

THE Standard Oil Company of New Jersey (New York), has awarded a contract to the Morse Drydock and Repair Company, Brooklyn, New York, at a price of $25,795 and 10 days' time, covering repairs to the motorship *E. T. Bedford*, bids for which were received recently. One other bid was received from the Robins Drydock and Repair Company, Brooklyn, New York, who submitted a figure of $39,740 and 10 days' time.

Tenders for Repair Work to African Line S.S. Eastern Glen

BIDS for repairs to the steamship *Eastern Glen*, operated by the American South African Line, Inc., New York, were received and opened in New York on Tuesday, May 17. Four tenders were received as follows:

Name	Price
Todd Shipyards Corporation.....	$10,400
Morse Drydock and Repair Company..	10,889
Robins Drydock and Repair Company..	11,268
Tietjen & Lang Drydock Company.....	11,950

Several prices were also submitted on a number of miscellaneous items which were not figured in the totals.

S.S. Unimak Undergoing Repairs

THE steamship *Unimak*, owned by the Richardson Company and which has been laid up on San Francisco bay since May 15, 1926, is being reconditioned at the yards of the General Engineering and Drydock Company, Alameda, California, preparatory to re-entering the company's trade between Stewart's Point and San Francisco. The price involved was not given out.

American Bridge Co. Submits Low Bid for Steel Barges

WITH a price of $11,190, the American Bridge Company, Ambridge, Pa., submitted the lowest proposal for the construction of 12 steel barges, bids for which were received by the Mississippi River Commission, First and Second Districts, Memphis, Tenn., on May 14. The Dravo Contracting Company, Pittsburgh, Pa., was the next lowest bidder with a price of $11,200. Five other bids were received ranging from $11,790 to $12,000. The award has not as yet been made.

Repair Jobs at Sun Yard

The freighter *Manhattan Island* was recently drydocked at the plant of the Sun Shipbuilding and Drydock Company, Chester, Pa., for miscellaneous repairs and painting. The Sun Oil Company's tanker *Atlantic Sun* has also been drydocked at the same plant for miscellaneous repairs and painting. The price involved was not given out.

Spear Engineers Corporation Submits Low Bid for Construction of Governors' Island Ferryboat

THE Spear Engineers Corporation, Norfolk, Virginia, submitted the lowest proposal on Monday, May 2, for the construction of a double-ended steel ferryboat for the War Department, Washington, D. C., for service in New York Harbor, Governors Island, in the amount of $202,000, with a Bessemer six-cylinder, 420-horsepower Diesel engine.

PLAN A.—This plan allowed considerable leeway in the type Diesel engine to be used, but specified one engine of about 400 horsepower.

PLAN B.—Diesel-electric drive, consisting of two Diesel engines of about 250-shaft horsepower, each driving generators, which in turn supply current to a propelling motor of about 375 horsepower. For general details of specifications see the May 1927, issue.

Other bids received include the following:

Charleston Drydock and Machine Company, Charleston, S. C.

Type engine	Plan "A"	Plan "B"
Lombard (6).....	$243,253	$270,491
Lombard (8).....	.....	265,266
Winton	243,533	255,906
De LaVergne (6).....	243,749	270,218
De LaVergne (8).....	.....	272,819
Ingersoll-Rand	250,620	.....
Worthington	246,452	272,269
Standard	240,004	284,508

Charles Ward Engineering Works, Charleston, West Va.

Type engine	Plan "A"	Plan "B"
Fairbanks-Morse	$247,800	.....
Bessemer (6).....	249,300	282,900
Bessemer (8).....	249,500	.....
De LaVergne.....	253,700	284,800
Standard	253,800	.....
Winton	256,700	274,500
Lombard (6).....	256,800	283,400
Lombard (8).....	.....	285,200
Worthington	258,500	286,500
Nelseco	261,600	.....
Washington Iron Works..	263,000	.....
Ingersoll-Rand	262,000	.....
McIntosh-Seymour	265,000	298,600
Bethlehem	.....	279,300

Southern Shipyard Corporation, Newport News, Virginia

Type engine	Plan "A"	Plan "B"
Worthington	$274,800	$300,000
De La Vergne.....	274,800	300,000
Winton	274,800	300,000
Fairbanks-Morse	274,800	.....
Standard	276,750	305,550
Lombard	279,300	324,200
Nelseco	285,560	.....
Washington Estep.....	285,000	.....
Ingersoll-Rand	286,400	.....
McIntosh-Seymour	287,513	320,800
Bethlehem	.....	304,350

Under Plan "B" the American Brown Boveri Electric Corporation, Camden, N. J., submitted a bid of $355,000 for the ferryboat equipped with Diesel-electric drive. The bids are now being analyzed in the War Department, Washington, D. C., and it is expected that an award will be made within a short time.

Overhaul of Freighter Upshar

The Merrill-Stevens Drydock and Repair Company, Jacksonville, Fla., has received the contract for repairing the freighter *Upshar*, owned by the Merchants and Miners Transportation Company. Complete overhauling of the *Upshar* will amount to several thousand dollars. She is operated regularly between Savannah, Jacksonville and West Palm Beach as a freighter.

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Notes from the Great Lakes

Lorain Yards Busy

AT an expenditure of over $7,000,000 eight Great Lakes freighters will be added to the fleets in 1927. This will be the greatest addition to the fleet in many years. Seven of the new freighters are destined for the ore, coal and grain trade. The eighth, a self-unloader, will go into the lake stone trade, and will have the largest cargo carrying capacity of any freighter on the lakes, exceeding even the capacity of the *Lemoyne*, the pride of the Canadian fleet owners.

Five vessels are under construction at the Lorain yards of the American Shipbuilding Company and indications point to a continuation of the brisk demand for new tonnage during the coming season.

This program of shipbuilding, the most extensive ever undertaken in the Lorain yards in a single season, is led by the Interlake Steamship Company, operated under control of the Pickands, Mather Company, of Cleveland, and headed by Harry Coulby, "Czar of the Great Lakes."

S.S. Harry Coulby Launched

THE Great Lakes freighter Harry Coulby was successfully launched at the Lorain yards of the American Shipbuilding Company on April 30. Mrs. K. A. Scott christened the new vessel. More than 500 spectators witnessed the launching, the party being headed by officials of the Pickands, Mather and Company, of Cleveland, owners of the Interlake Steamship Company for which the vessel is being built. Mr. Coulby is chairman of the Interlake concern and a high official in the firm owning the company. The *Coulby* is the largest American owned freighter on the lakes and will be equipped with every modern improvement known to marine engineering, including wireless, gyro compass and radio direction finder. She is 630 feet long, 65 feet beam and will have a cargo capacity of 13,800 tons of ore. Propulsion is by triple expansion engines supplied with steam by watertube boilers.

The *Coulby* was the third vessel launched this season for the Interlake Steamship Company, the *McLaughlan* and *Robert Hobson* being the other two.

Draft of Vessels Increased on Lakes Michigan and Superior

CHEERFUL news for vesselmen, shippers and mariners was received May 2 in the announcement that the store captains' committee of the Lake Carriers' Association had recommended an increased draft to 19 feet to and from ports on Lakes Michigan and Superior.

This is 9 inches over what it was this time last year, and 3 inches over the opening draft recommendation for this year.

The additional draft will mean much larger cargoes of iron ore, grain, coal and other commodities for the ships plying the Great Lakes. Last year the draft was raised by easy stages beginning at 18 feet 3 inches, raised to 18 feet 6 inches June 9, then 18 feet 9 inches July 2 and on July 22 to that of the present recommendation of 19 feet.

New Pittsburgh Freighter Goes Into Commission

THE steamer *A. F. Harvey*, which was built at the River Rouge yard of the Great Lakes Engineering Works for the Pittsburgh Steamship Company, was turned over to the owners on the date named in the contract and was placed in commission May 17, when she sailed for Duluth to load ore. Capt. S. C. Allen of Cleveland brought the new boat out and G. L. Barnhart is chief engineer.

Chicago Harbor Improvements

THE new port at the Chicago plant of the Universal Portland Cement Company will expand through expenditures of over $2,000,000. This development is a unit of the Chicago harbor improvement program. A new lighthouse, a concrete dock, 1,800 feet long and 500 feet wide, a 55 acre harbor basin, a 30 acre storage yard and electrically operated belt conveyor nearly a mile long are units of the cement concern's development program which will soon start.

S.S. Niagara Now a Sand Sucker

THE steel steamer *Niagara*, recently bought from Boland & Cornelius by the Gravel Products Corporation of Buffalo, and converted into a sandsucker at the yard of the Globe Shipbuilding Company, made her first trip in her new line of traffic May 2, going to a point up Lake Erie for a load of sand. She is said to be the largest sand steamer now working out of Buffalo, if not along the entire chain of lakes. She is equipped with every known modern device, and presents a fine appearance. George Bacon is chief engineer.

Steel River Barges in Demand

THE Pittsburg Coal Company is figuring on letting contracts for 35 more barges for use on the Ohio river in addition to the 40 to be built by the Riter-Conley Company.

The Wheeling Steel Corporation is also working out a program for new barges wanted for the Ohio river trade.

In addition to steel for 25 barges for the Federal Barge Line on the upper Mississippi river, steel for 12 new barges for the Mississippi River Commission is being sought in Pittsburg, and three or more vessels for the United States engineers are soon to be constructed.

Cleveland Harbor Developments Approved

AFTER years of negotiation federal approval of a new harbor line for Cleveland has been assured by Major DeWitt Jones, U. S. engineer in Buffalo, and Colonel Spencer Vosby, U. S. army engineer in charge of Great Lakes projects. The plans conform to the agreement between the engineers and City Manager W. R. Hopkins and call for an eventual expenditure of $15,000,000. If no further obstacles arise the plans will receive the final approval of the War Department in Washington within a few weeks. Actual work will probably be started this summer by the city and the Cleveland council will be asked for development funds.

The lake front plans include: New port facilities for 100 vessels or ocean going ships. One thousand acres of reclaimed lake front land where rail and water transportation facilities meet, the site to be used for industrial purposes. A marginal railroad serving the new docks and industries. A 185-foot super highway along the lake from the Mall to Gordon Park, and new bulkheads.

D. & C. Line to Offer Daylight Service

DAYLIGHT service between Cleveland and Detroit on the Detroit & Cleveland Navigation Company's lines will be inaugurated during July and August, according to A. A. Schantz, president. Daylight boats will run on Wednesdays and Saturdays during the two months leaving each port at 11:30 a. m. and arriving at 6:30 p. m. Regular night service between Detroit and Buffalo started May 16, the first boat leaving Detroit at 5:30 p. m. arriving at Buffalo at 8:30 a. m. The return trip starts from Buffalo at 6 p. m. arriving at Detroit at 9 a. m.

The Cleveland-Detroit boats which have been running about a month and a half are reported carrying far more passengers than during the same time last year.

Vessel Sales

The Mid-West Transportation Company has added another ship to its fleet through the purchase of the *Montfaucon* from the American Shipbuilding Company. The vessel is of the 3,000-ton type and will be used in the coal, stone and cement trade, according to Frank J. Peterson, Cleveland manager.

She is now at Buffalo and the crew of the *Lingeman* is there fitting her out while the *Lingeman* is being equipped with conveyors to expedite unloading of cement, which the boat will be used to transport. The conveyors, however, are portable and the vessel can be used for other cargoes, when needed.

Under an order of the admiralty court sitting at Grand Rapids, Mich., the steamers *Manitou* and *Puritan* of the Great Lakes Transit Company were sold April 20, at Manistee, Mich.

The lake steamer *City of Ignace*, which was sold at public auction by the United States marshal in Cleveland recently for $65,000, is defendant in another series of libel suits brought by her crew. Colen McMillen, a deck hand, filed the latest suit for wages.

The steamer *Scranton*, of iron construction, well known along the lakes, was bought at a United States marshal's sale at Buffalo, May 2, by Norman J. Miller, representing the William H. Sharp estate of Detroit, for the sum of $22,000. She was formerly the property of Charles S. Neff of Milwaukee, Wis., and was sold to satisfy sundry claims amounting to $20,000.

Three freighters have been purchased from the Pittsburgh Steamship Company by G. A. Tomlinson of the Tomlinson Fleet. The ships are the *Coralia*, *Empire City* and *Crescent City*. The vessels were purchased for interests outside the Tomlinson organization.

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Lake Carriers Students Receive Original Licenses or Raise of Grade

STUDENTS successfully completing the regular courses in navigation and marine engineering conducted by the Lake Carriers' Association in Cleveland and Marine City, for the past season, were announced recently by George A. Marr, secretary of the association.

The school, which is operated without cost to students, affords an opportunity to ambitious young men to secure an original license or raise in grade, after completing a course and passing the examination.

The following from the Cleveland engineering class received original licenses:

George W. Campbell, second assistant unlimited; Stanley J. Dauscher, second assistant, unlimited; Alfred P. Dwyer, second assistant, unlimited; Edward J. Ehman, second assistant, unlimited; Arthur W. Johnson, second assistant, unlimited; Charles G. Johnson, first assistant, 3,000 tons; Thomas R. Judge, second assistant, unlimited; August W. Kransvogel, second assistant, unlimited; August Lutgemeier, second assistant, unlimited; Clarence M. Myers, second assistant, unlimited; Benedict E. Petron, second assistant, unlimited; Mark C. Smith, second assistant, unlimited; Harold G. Whitney, second assistant, unlimited; Harry J. Visser, second assistant, unlimited; Ralph W. Hawes, second assistant, 8,500 tons; Jacob Jacobson, second assistant, 6,500 tons.

The following from the Cleveland engineering class obtained a raise of grade:

Fred O. Hayden, to chief engineer, unlimited; Sigurd K. Ramberg, chief engineer, unlimited; Raymond G. Buehler, chief engineer, 9,000 tons; Ralph W. Hogle, chief engineer, 8,500 tons; Joseph J. Brandabur, first assistant, unlimited; Michael Reader, first assistant, unlimited; William A. Goerss, first assistant, unlimited; Alex Kucinski, assistant, 9,000 tons; Hans P. Birk, first assistant, 8,500 tons; John P. Burke, first assistaht, 8,500 tons; Michael Burmak, first assistant, 8,500 tons; Frank W. Campbell, first assistant, 8,500 tons; Oscar E. Pearson, first assistant, 8,500 tons; William H. Rowe, first assistant, 8,500 tons; Alan Sealye, first assistant, 8,500 tons; Stephen A. Sharkin, first assistant, 8,500 tons; Albert Riese, to first assistant.

The following from the Marine City Engineering class obtained a raise of grade:

Andrew R. Brabaw, to chief engineer, unlimited lake and ocean; Albert S. Spencer, chief engineer, unlimited; David J. Stockwell, chief engineer, unlimited; John A. Shannon, chief engineer, unlimited; Herbert A. Brown, first assistant, unlimited; Bernard Mitchell, first assistant, unlimited; John Hubbard, first assistant, 5,000 tons; Hugh McCarville, first assistant, unlimited; Norman F. Simons, first assistant, 5,000 tons.

Vessel Repairs

The steamer *Kiowa* loaded with salt went ashore at Bellevue Island, near Detour, and wreckers were sent to her relief.

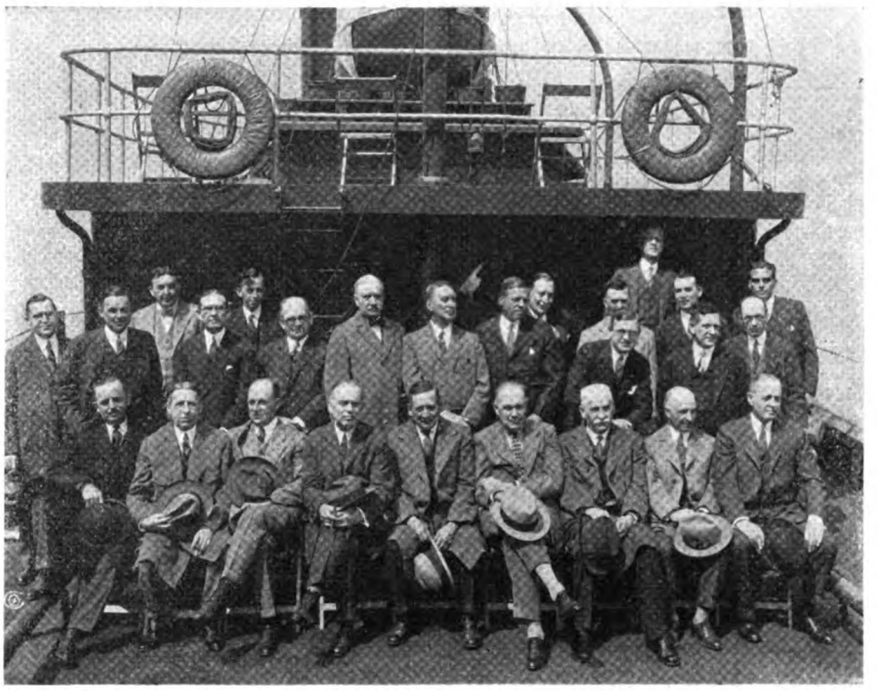
It required several hours for the tug *New York* to release the lake freighter *W. D. Rees* which went aground on a sand bar inside the Buffalo harbor entrance. The federal dredge *Burton* is working on the harbor now.

The steamer *Cornell* which was damaged in a fire at the Central Furnace dock, Cleveland, has been sent to a shipyard for repairs.

The lake wrecker *Favorite* released the steamer *Parks Foster* which went ashore at Sheboygan. She carried a cargo of automobiles.

The steamer *William Fairbairn* was sent to a shipyard in Cleveland. She damaged several plates when she hit a pier in the Soo.

The steamer *A. H. Ferbert*, going into Lorain with a cargo of stone, hit the steamer *James E. Davidson*, which was tied up in ordinary at the B. & O. ore dock, and both boats were damaged. The *Ferbert* was taken to the shipyard for repairs.



Guests of George Le Boutillier, vice president of the Long Island Railroad, on board the new oil-electric tug Meitowax, latest addition to the Long Island's harbor fleet

American Welding Company Takes Over Business of Continental Iron Works

THE Continental Iron Works with its plant at Calyer and West Streets, Brooklyn, N. Y., one of the oldest established companies of its kind in America and the largest builder of corrugated furnaces and furnace fronts for Scotch boilers is retiring from active business and is now in the process of dissolution.

The American Welding Company, a subsidiary of the American Car and Foundry Company, has purchased from the above company the special machinery used in the manufacture of Morison suspension furnaces and Morison patent furnace doors and fronts, and this machinery is now being installed, and will shortly be ready for operation, at its Carbondale plant.

The trade names heretofore used by the Continental Iron Works with reference to Morison suspension furnaces and Morison furnace doors and fronts, are now the property of the American Welding Company.

In the continuation of the production of furnaces and fronts, a number of the employes of the Continental Iron Works who are experienced in their manufacture will be added to the Carbondale organization of the American Welding Company.

In taking over the trade names and the machinery, the American Welding Company, in addition to its own long established business, takes over also the traditions and ideals of the retiring company and proposes to serve not only the long established clients of the Continental Iron Works but to extend the benefits of this special service to wider and broader fields.

Lake Vessel Burns

The *G. W. Parker*, a sand and gravel boat owned by Whitt Parker and Captain Clarence Warner, of Algonac, burned May 10, in the channel six miles south of Algonac. The craft was valued at $35,000. The crew were saved without injuries.

Oil Electric Tug Meitowax

GEORGE LE BOUTILLIER, vice-president of the Long Island Railroad Company, was host recently to a party of railroad, shipbuilding and industrial engineering executives on a special trip around New York Harbor, on board the new oil-electric tug *Meitowax* the latest addition to the Long Island's harbor fleet.

The *Meitowax*, which is 108 feet long, 26 feet beam and 12 feet 3 inches depth, was built by the Staten Island Shipbuilding Company at Mariners' Harbor, Staten Island, N. Y., and is equipped with two 340 brake horsepower Ingersoll-Rand "PR" 6-cylinder, 4-cycle, 13 by 19-inch oil engines, each direct connected to a 230-kilowatt Westinghouse compound-wound generator and 25-kilowatt exciter, which are non-reversing and operate at a constant speed of 265 revolutions a minute. The generators are connected in series and normally supply 480-volt direct current for the 565 shaft horsepower double armature, shunt-wound Westinghouse propulsion motor. The oil engines operate on solid injection of fuel oil. All engine room auxiliaries are driven by motors.

S.S. Venus Reconditioned

THE lake freighter *Venus* of the Interlake Steamship Company, controlled by the Pickands, Mather and Company, of Cleveland, has been reconstructed along lines similar to those of the *Lagonda* of the same fleet and will be used for carrying steel scrap and pig iron. Her first trip was from Buffalo.

C. & B. Steamers Being Repaired

Extensive renovations and repairs are being made on the Cleveland and Buffalo line of steamers, *Goodtime* and *Seeandbee*, preparatory to their going into passenger service, June 12. General manager G. A. Bomm announced that beginning July 5 the *City of Erie* and the *City of Buffalo* will make stops at Erie.

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TRADE PUBLICATIONS

SEAMLESS STEEL PRODUCTS.—Forged, rolled and drawn seamless steel products for high pressures and temperatures have been made the subject of a catalogue issued by the Seamless Steel Equipment Corporation, New York. In this catalogue are listed a great number of typical applications of seamless steel, including forged drums, boiler shells, chemical drums and the like.

ELECTRICAL EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued a series of loose-leaf pages describing new electrical equipment recently placed on the market by this company. The descriptions include hand starting compensators, automatic starting compensators, shoe type solenoid brakes, control equipment of various kinds and the 500 series squirrel gage motors.

DIESEL ENGINES.—The Busch-Sulzer Bros.-Diesel Engine Company, St. Louis, Mo., has issued an announcement in the form of a bulletin of the conversion of the tanker *District of Columbia* owned by the Standard Oil Company of California from steam to Diesel electric drive. Four 1,000 brake horsepower Busch-Sulzer type "E" Diesel engines are to be used for power in the converted tanker.

DIESEL ENGINES.—The first motor driven transatlantic passenger liner, the *Gripsholm*, equipped with Burmeister & Wain 4 cycle double acting Diesel engines having a total of 13,500 brake horsepower has been made the subject of a booklet by Burmeister & Wain, Ltd., Copenhagen, Denmark. The unusual feature of this book in addition to a complete illustrated description of the *Gripsholm* is a complete record of the operation of the engines with extracts from the log covering the first year's service of this vessel.

ELECTRICAL COOKING EQUIPMENT.—Price lists and descriptive specifications of various types of commercial cooking and baking equipment have been issued by the Edison Electric Appliances Company, Inc., Chicago, Ill. Special attention is called to a new line of bake ovens designated as the "Ad-A-Deck" type. New design ranges and boilers have also been added to the list of Edison equipment.

EQUIPMENT FOR POWER PLANTS.—In Bulletin H.O. 1900 recently issued by the Worthington Pump & Machinery Corporation, New York, is discussed modern power plant practice with special attention to steam condensers, pumps, air compressors, Diesel engines, gas engines and oil and water meters. The bulletin is well illustrated and contains practical information on power plant engineering.

BUSINESS NOTES

Suzuki & Company has moved its offices from 220 Broadway to 185 Madison avenue, New York.

Robert T. Kent, until recently superintendent of Prison Industries, State of New York, has been appointed to the position of general manager of the Bridgeport Brass Company, Bridgeport, Conn.

Frederick K. Lord, naval architect and yacht broker, announces the removal of his office from 120 Broadway to the Graybar building, 420 Lexington avenue, New York.

M. J. O'Connell has been appointed marine representative of the E. I. du Pont de Nemours and Company, Inc., Chemical Products Division, for the metropolitan district and Boston, with offices at 21 East 40th street, New York.

J. P. Alexander has been appointed Boston manager in charge of all sales and service in New England for the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

H. Dormand, formerly connected with the chartering department of A. H. Bull & Company, agents, New York, has joined the staff of the Columbus Line, Inc., 15 Moore street, New York.

The Philadelphia Derrick & Salvage Company has moved its offices from 334 Bourse building to Delaware avenue and Vine street, Philadelphia, Pa.

The American Bureau of Shipping has removed its headquarters from 50 Broad street to its own building (The Stevenson Taylor Memorial building) at 24 and 26 Old Slip, New York.

G. E. Wearn has been appointed central station sales manager of the Westinghouse Electric and Manufacturing Company, with headquarters in New York City.

William B. Senseman has been appointed Pacific Coast District Manager for Combustion Engineering Corporation, Raymond Bros. Impact Pulverizer Company, Ladd Water Tube Boiler Company and Heine Boiler Company, all subsidiaries of International Combustion Engineering Corporation. Mr. Senseman has been associated with Raymond Bros. Impact Pulverizer Company for the past 15 years and since 1917 has represented that organization on the Pacific Coast. The new consolidated offices are located in the Subway Terminal Building, 417 South Hill St., Los Angeles, California.

H. A. Couse, a member of the law department of the General Electric Company, has been appointed general counsel of the incandescent lamp department, with offices at 120 Broadway, New York City. Philip D. Reed will be asociated with Mr. Couse at his New York office. F. H. Babcock of the central station department, has been designated as assistant to Charles W. Appleton, who was recently elected vice-president in charge of general relations with public utilities.

The Prest-O-Lite Company, Inc., manufacturers of storage batteries, acetylene gas and gas tanks, announces the sale of its storage battery business to a new company, The Prest-O-Lite Storage Battery Corporation. The new company will continue to operate the battery plant at Speedway, Indiana. F. H. Landwehr, of Toledo, has been elected president of the new company, J. H. McDuffee, of Indianapolis, vice-president, and J. B. Motley, also of Indianapolis, secretary and treasurer. These gentlemen, with F. M. Coburn and F. A. Harrington, constitute the board of directors. The Prest-O-Lite Co., Inc., while discontinuing the battery branch of its business, will continue the manufacture and sale of acetylene gas.

Marine Societies

America

American Marine Association. 30 Church St., New York. President—Col. E. A. Simmons.

American Marine Standards Committee. Chairman, Colonel E. A. Simmons. Secretary, A. V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

American Society of Marine Designers. Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass.

American Society of Marine Engineers. 605 Market St., San Francisco, Calif. President—Henry F. Gelhaus. Secretary—Wm. H. Thille.

American Society of Naval Engineers. Navy Department, Washington, D. C. Secretary-Treasurer—Commander H. B. Hird, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

American Steamship Owners' Association. 11 Broadway, New York. President—H. B. Walker.

Atlantic Coast Shipbuilders' Association. 1600 Walnut Street, Philadelphia, Pa. Secretary—C. S. King.

Council of American Shipbuilders, Inc., 30 Church St., New York. President—Homer L. Ferguson. Secretary-Treasurer—Henry C. Hunter.

Jersey Marine Club, 4th and River streets, Hoboken, N. J. President—Col. Bartlett.

Lake Carriers' Association. President—J. S. Ashley. Secretary—George A. Marr, Rockefeller Building, Cleveland, O.

National Association of Engine and Boat Manufacturers. 29 West 39th Street, New York City. Secretary—Ira Hand.

National Association of Masters, Mates and Pilots. National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

National Marine Engineers' Beneficial Association. Headquarters, 311-315 Machinists Building, Washington, D. C. President—Wm. F. Yates. Secretary—Albert L. Jones.

National Merchant Marine Association. Munsey Bldg., Washington, D. C. President—Hon. J. E. Ransdell.

Neptune Association. 21 Pearl St., New York City. Secretary-Treasurer—Captain John F. Milliken.

New York and New Jersey Dry Dock Association, 111 Broadway, New York. President—Jonathan Moore.

Ocean Association of Marine Engineers. 15 Whitehall St., New York. Secretary—Bert L. Todd.

Port of New York Authority. 75 West Street, New York. Chairman—George S. Silzer. Secretary—Wilson J. Vance.

Society of Naval Architects and Marine Engineers. 29 West 39th Street, New York. Secretary and Treasurer—Daniel H. Cox.

The Maritime Association of the Port of New York. 78 Broad St., New York City. President—John Dowd. Secretary—John F. Manning.

The New York Tow Boat Exchange. 11 Moore St., New York. Manager—Charles A. Mason.

The Propeller Club of the Port of New York. President—Harry W. Parsons, 111 Broadway, New York. Secretary—W. Z. Gardner, 32 Broadway, New York.

United States Naval Institute. Naval Academy, Annapolis, Md. Secretary and Treasurer—Captain H. A. Baldridge, U. S. N.

United States Ship Operators' Association. 149 Broadway, New York. President—Winchester Noyes.

Canada

Grand Council N. A. of M. E. of Canada. Grand Secretary-Treasurer—W. A. MacDonald, 62 Albert St., Halifax, N. S.

Great Britain

Institute of Marine Engineers, Incorporated. 85/88 The Minories, London, E.1.

Institution of Engineers and Shipbuilders in Scotland. 39 Elmbank Crescent, Glasgow.

Institution of Naval Architects. 5 Adelphi Terrace, London, W. C.

North East Coast Institution of Engineers and Shipbuilders. Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

France

Association Technique Maritime et Aéronautique. Secrétariat Général—7, rue de Madrid, Paris (8e).

Italy

Collegio Degli Ingegneri Naval e Meccanici in Italia.

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